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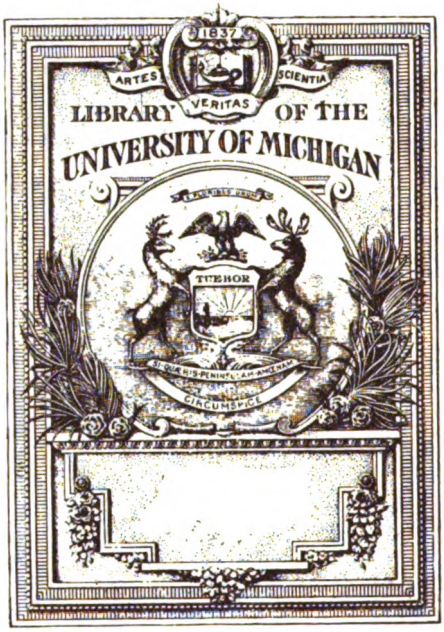

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TRANSACTIONS

OF THE

WISCONSIN ACADEMY

OF

SCIENCES, ARTS AND LETTERS

VOL. XIX, PART I

MADISON, WISCONSIN
1918

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ARTHUR BEATTY,
Secretary.

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EIGHT UNEDITED LETTERS OF JOSEPH RITSON

HENRY A. BURD

Joseph Ritson (1752–1803) was by profession a Conveyancer. Early in life he was apprenticed to a reputable practitioner of his native town, Stockton-upon-Tees. Late in 1775 he went up to London, entered an established office for five years, and afterwards set up for himself, taking chambers in Gray's Inn, where he resided till his death. Conveyancing was, however, merely a bread-and-butter profession. Although he had a respectable clientage, he made no efforts to increase it. The half dozen volumes which he published in connection with his profession were primarily historical and antiquarian in nature, and were recognized by his contemporaries as authoritative. But his chief interest and his major work lay in another field.

As a lad at Stockton Ritson read widely, especially in the older periods of English poetry. His reading, together with his friendship with Allan, Cunningham, Holcroft, and Shield, and his proximity to the famous antiquities of the north of England, gave a permanent direction to his interests. When he arrived in London, he possessed a deep interest in literary and topographical antiquities and had an uncommonly good foundation on which to build his studies. He pursued his researches in the famous libraries in and about the metropolis and soon began publishing the results. Eccentric habits of life early marked him off from his fellows, and a violence of language, coupled with idiosyncrasies of style and an insistence upon critical and editorial standards not then in the highest vogue, soon distinguished him as a writer. Posterity knows Ritson best, if not solely, for his collections of ballads and romances, 1) and for the virulence and acidity of his attacks

[1] Especially *English Songs*, *Scotish Songs*, *Robin Hood*, and *Ancient English Metrical Romances*.

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upon Warton, Percy, and Pinkerton. From his manner in these controversies is drawn the conclusion that the same characteristics predominate in everything he wrote. But such an impression is largely mitigated, if not wholly expelled, by even a casual perusal of the published correspondence. While it is not my purpose to attempt to vindicate Ritson of the charges which have long stood against him, yet the bit of new evidence which is here presented—intimate and personal in nature—may aid in a fairer and more intelligent judgment.

These eight letters of Ritson cover a wide range. 2) The first is the earliest yet discovered, and shows the hero-worship of youth; the last was written two years before his death, and exhibits the critical temper of mature years. In the books and manuscripts which he purchased and borrowed—a commerce in which he was actively engaged all his life—they reveal the field of his major interest as well as his special concern at a given time, and they give a hint of the wide range of his friendships as well as of the deep concern with which he viewed a possible rupture with a friend whom he had injured or by whom he thought he had been affronted.

The first letter bears no address, but it was evidently written to John Cunningham (1729–1773), itinerant actor and small poet, who spent his dissolute life with strolling companies in the north of Britain and wrote occasional prologues, a farce or two, and some pastoral poems of slight merit. Cunningham, perhaps in company with Thomas Holcroft (1745–1809), the political reformer, and William Shield (1748–1829), the famous musical composer, met Ritson, then a young legal apprentice with literary aspirations, and immediately fell heir to his homage. They corresponded infrequently during the period of Cunningham's voluntary retirement to the house of Slack, the printer at Newcastle, where he was waiting "till my health either seems to return, or totally abandons me." But three of these letters seem to have been preserved. Two of Cunningham's, dated respectively June 19, 1772 and July 23, 1773, are printed in Sir Harris Nicolas's

[2] With the exception of the second, the originals of these letters are in the Bodleian, British Museum, and University of Edinburg Libraries. The MS. of the second letter is in the collection of Mr. Marsden J. Perry, of Providence.

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Memoir of Ritson. 3) The following, from Ritson, is a reply to the first of these. 4)

MS. Montagu d. 15, fol. 219, 219b.

Stockton 5) Friday
—th Augt. 1772

Dear Sir

The pleasure I received from your agreeable favor was a little damped by your treating as *Flattery* the most sincere Expressions my pen could commit to paper.

I can have small hopes of enjoying the least share in your Thoughts when you will not believe me if I speak Truth. But I had rather that you should tell me I lye than a 1000 others I could name should commend me for speaking Truth.

As to your Expectations of seeing Lanc. 6) and me at Durham in the Race Week. I am sorry they had so bad a foundation. The pleasure I would have received from seeing you would have abundantly compensated for any trouble I might have been at in the Journey. But as I have never had a Day nor the Offer of a Day (except Sunday) from my Master 7) since I entered his office, I never could have expected to succeed had I asked him. I believe Lanc. is much

---

[3] *The Letters of Joseph Ritson, Esq., Edited chiefly from originals in the possession of his nephew. To which is prefixed a Memoir of the Author by Sir Harris Nicolas,* 2 vols., London, 1833, Vol. I, pp. viii–x.

[4] Ritson manifested an especial interest in Cunningham. Several of his songs, together with an estimate of his poetic ability, were printed in *A Select Collection of English Songs, with their Original Airs; and a Historical Essay on the Origin and Progress of National Song,* Second edition, 3 vols., London, 1813, Vol. 1, pp. xc, 230, 236; Vol. II, p. 165; and still others were included in *The Northumberland Garland; or Newcastle Nightingale; a Matchless Collection of Famous Songs,* Newcastle, 1793, p. 69. At the time of the poet's death Ritson collected a great many newspaper extracts concerning him, and from these and his personal knowledge, wrote a short biographical sketch, which was printed by Nicolas, Op. Cit., Vol. I, p. vii note. See also *Letters,* Vol. 1, p. 144, and J. C. Walker, *Historical Memoirs of the Irish Bards,* London, 1786, p. 85.

[5] Although Ritson was born and bred at Stockton-upon-Tees, he seldom used the full address in his correspondence. As a result of this abbreviation there arose a dispute as to the place of his birth, some maintaining that it was Stockton in Yorkshire. See John Nichols, *Literary Anecdotes of the Eighteenth Century,* 9 vols., London, 1812–15, Vol. VIII, p. 133 note, and *Illustrations of the Literary History of the Eighteenth Century,* 8 vols., London, 1817–58, Vol. VIII, p. 588.

[6] Probably a fellow apprentice, Lancaster.

[7] Ralph Bradley, distinguished conveyancer, author of *Practical Points, or, Maxims in Conveyancing,* London, 1804.

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in the same Situation. Yet I hope (as it is likely we shall have Races) I shall enjoy that pleasure before *Christmas*—& if you are not inrolled in the List of ye Racing performers I have a little Expectation of seeing you at Whitby then.

I am exceedingly glad your Benefit at Darlington turned out to your Satisfaction. You say "you have often Experienced the friendship of Darl. as well as Stock."—long very long may you continue to enjoy the Friendship of both. Tho' Merit is seldom rewarded so well as it should be — Yet the Place must be a damn'd stupid one indeed to let it be neglected.

We have had the "famous and unparalleled" Mr. Jonas the Jugler here — his Visit indeed was only short but as he performs his Part much better than any other Pretender to the Art — the Spectators are as much pleased as astonished.

There is not the least Necessity for the Letters you honor me with "to be left at Mrs. Barkers."[8] Directed to J. Ritson at Ra: Bradley's Esqr Stockton they will be much sooner received as I seldom know there is a Letter till three or four Days afterwards.

My Imagination's so shallow, it is the most vain Undertaking possible, for me to pretend corresponding with you. Yet if my stupid Letters have only the good fortune to procure one in return — I am happier than if I were the Author of Mr. Pope's Literary Correspondence.

I am
Dear Sir
With the greatest Respect
Your most humble Servant
J. Ritson Jun

The next letter, likewise unaddressed, was written to Isaac Reed, and forms a not unimportant link in a chain of Shakespearian controversy which involved, besides Ritson and Reed, several prominent persons, notably Johnson, Steevens, Malone, and Farmer. Ritson's first publication in this connection was a volume of scattered notes, *Remarks, Critical and Illustrative, on the Text and Notes of the Last Edition of Shakspeare,* London, 1783, directed against Johnson and Steevens and their 1778 edition of Shakespeare. The critic's manner

[8] Ritson's landlady.

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was characterized by vindictiveness, virtuperation, and personal abuse; but the volume contained much sound criticism and many valuable observations. Many of these notes were incorporated in Reed's *Shakspeare* (sometimes known as the third edition of the Johnson and Steevens *Shakspeare*), some were ignored, and a few were held up to sarcastic ridicule. Being extremely sensitive about his own writing, guarding it, as he said, as jealously as a father does his offspring, Ritson immediately prepared notes on this edition, and especially on the comments which had been made concerning his observations in the *Remarks.* These notes were not then intended for the public, but he was later inspired to publish them as *The Quip Modest; a few words by way of Supplement to Remarks, Critical and Illustrative, on the Text and Notes of the Last Edition of Shakspeare; occasioned by a Republication of that Edition, revised and augmented by the Editor of Dodsleys Old Plays,* London, 1788.

Even though generally displeased with the reception given the *Remarks* by the editor of the 1785 *Shakspeare,* Ritson was particularly offended at three notes in which, to use his own words, "I found or imagined I was treated with contempt."[9] These were: (a) In the *Remarks,* p. 12, Ritson had expressed the belief that 'King Edward shovel boards,' *M. W. W.*, I. i. 154, referred to 'broad shillings of Edward III' and not of Edward VI, as Farmer had stated. An italicized note in the Reed *Shakspeare* castigated him for 'censuring' Farmer, denied his assertion, and dismissed the note as *'not worth consideration'.*[10] (b) After devoting a page and a half to Ritson's note on the mortality of fairies, *M. N. D.*, II. i. 101, the editor concluded thus: "It is a misfortune as well to the commentators, as to the readers of Shakspeare, that so much of their time is obliged to be employed in explaining and contradicting unfounded conjectures and assertions. . . A future editor of our author may without any detriment to his work omit this note, which I should have been better pleased to have had no occasion to incumber the page with."[11] (c) Upon Ritson's demanding that Dr. Johnson present some other proof than his own assertion that Shakespeare was guilty

[9] *Letters,* Vol. I, p. 105.
[10] Vol. I, p. 253.
[11] Vol. III, p. 37.

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of an anachronism in introducing 'rapier' into *Richard II*, IV. i. 40, the editor remarked: "It is probable that Dr. Johnson did not see the necessity of citing any authority for a fact so well known, or suspect that any person would demand one." 12)

Upon reading these notes one wonders why Ritson should have been so wrought up as to feel that he had a personal quarrel with the man who wrote them. It is certain that imagination and a supersensitive nature played a rather large part in exciting his anger. Outside of the two letters that have been preserved, the only explanation of his point of view is to be found in *The Quip Modest*. There he admitted that he was guilty of a 'gross blunder' about King Edward shovel boards, but he resented the statement that he had censured Farmer, for whom he professed the highest regard, and declared that he had only expressed a difference of opinion. In the discussion on the mortality of fairies Ritson knew he was in the right, and he steadfastly maintained his ground. It was the insinuating nature of this note to which he objected, and to the editor's parting fling he answered in his richest vein of sarcasm: "The editor might, without any detriment to his work, have omitted the above note; but I cannot think that the *page* has any particular reason to complain of the incumbrance, as it would be no difficult matter to point out several hundreds groaning under an equal burthen." 13) In the last note Ritson was incensed at the notion that he should be criticised for insisting upon an editor or commentator performing his proper function—that of substantiating opinion with fact wherever possible.

Ritson immediately made known his dissatisfaction with these notes. He held much store by Reed's friendship and professed to believe that they came from some 'friend in the dark,' possibly Steevens, rather than from the ostensible editor. But when the exchange of several letters failed to bring a disavowal from Reed, Ritson began to think that he had probably been mistaken. When he published *The Quip Modest*, it contained an extremely vicious preface (a part of which it was thought necessary to tone down before many copies had been sold) in which Steevens was wickedly reviled

[12] Vol. V, p. 227.
[13] *Quip Modest*, p. 14.

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and Reed rather awkwardly exonerated. It was then that Reed flatly disclaimed the notes by which Ritson had felt himself to be most injured. The critic's reasons for his conclusions and his sincere desire to avoid a break with his friend are eloquently set forth in this reply to Reed. 14)

Perry MS.

Dear Sir,

I plainly perceive that the little pamphlet I have published 15) will be productive of a consequence which it must be evident I have sought to avoid, & for which I shall be very sorry.

That I have often thought and said that the notes at which I have taken offense could not possibly proceed from you is a fact well known. I declared my belief of it to yourself in the letter I wrote soon after the publication of your Shakspeare; 16) — you could then, I thought, so easily have undeceived me, that your silence tended to authorize & confirm my belief. I cannot however doubt the assertion you now make — but I am more and more at a loss to account for the language and manner of your notes which so far as you were personally concerned were without the least provocation on my side and could not fail to give the most unfavorable impression of my character to every one who knew who was meant by the Author of the *Remarks*. It would surely have been generous & friendly at the least to have afforded me an opportunity of defending myself against the charges you thought me liable to, before the publication of the book, that I might have had a chance of convincing you that the Remarks objected to were neither so false nor so foolish as they were represented. 17) You adopted a mode of conduct which it would have been perfectly natural for me to expect from

---

[14] A more complete account of the Shakespearean controversy will be found in my article on "Joseph Ritson and Some Eighteenth Century Editors of Shakespeare", in *Shakespeare Studies* by Members of the Department of English of the University of Wisconsin, Madison, 1916, pp. 253–75.

[15] *Quip Modest.*

[16] See letter to Reed, Jan. 19, 1786, in Ritson's *Letters*, Vol. I, pp. 105–8.

[17] This was characteristic of Ritson in controversy. He was always the last to allow his "victim" an opportunity of defense against attack and the first to demand it when the weapons were turned upon himself.

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Mr. Warton 18) or Mr. Malone 19) but certainly not from you.

I have no intention whatever of troubling the public with anything more upon the subject. My only wish was to justify myself which I hope I have done to the satisfaction of every unprejudiced person.

You will do me the justice to believe that I never entertained the the most distant suspicions of your having any concern in the scurrilous libel you allude to 20) — but both Baynes 21) & I were very much surprised to see it noticed in your list 22) which we concluded it would not have been if you were unacquainted with its contents, & which it was equally difficult to conceive why it shod have been if you were not.

I should consider myself a person of neither honour or honesty if I had been actuated in this publication by the least spark of resentment against you & I beg leave to assure you that notwithstanding what has passed I shall still continue to preserve the respect and esteem to which your personal character & literary services have so just a claim.

I am,
Dear Sir,
Your very obliged & obed. serv.
J. RITSON.

Grays Inn,
22d. Feb. 1788.

The following letter shows primarily Ritson's antiquarian interest. It is directed to William Laing (1764–1832), Edin-

[18] See Ritson's *Observations on the three first volumes of the History of English Poetry, in a familiar letter to the author*, London, 1782, and the controversy which was subsequently waged in the *Gentleman's Magazine*, Vols. LII, LIII.

[19] Malone's *Supplement to the edition of Shakespeare's plays published in 1778*, London, 1780, his *Second Appendix to Mr. Malone's Supplement*, London, 1783, and his own edition of Shakespeare contained violent abuse of the author of *Remarks* and *Quip Modest*. Ritson retaliated in kind in his *Cursory Criticisms on the edition of Shakspeare published by Edmond Malone*, London, 1792.

[20] *A familiar address to the curious in English poetry, more especially to the readers of Shakespeare*, by Thersites Literarius, London, 1784. This pseudonymous tract greatly offended Ritson, as it was written with the obvious intention of creating the impression that it came from him.

[21] John Baynes (1758–1787), author of anonymous political verses and translations from French and German poems, was the friend whom Ritson selected, at Reed's suggestion, to arbitrate their differences. See *Letters*, Vol. I, p. 132.

[22] "A list of detached pieces of criticism", in Reed's *Shakspeare*, Vol. I, pp. 261–6.

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burgh bookseller and antiquarian, with whom he had both private and professional dealings for many years. It was Laing who introduced him to Herd at the time when he was seeking assistance in collecting the material for his edition of *Scotish Songs*, and who furnished much material relative to the poets of the North.

The titles which stand at the head of this letter have evidently been taken from the bookseller's catalogue, and it is impossible to trace them down with absolute certainty. Only one of the entire list appears in the catalogue of the sale of Ritson's library, so that it would seem that his fear that most of them were already disposed of when he wrote, had been well founded.

No. 104 Case 23)
x435 Dissertatio 24)
603 Tristan 25)
808, 809 } Hailes 26)
903 A proper project 27)
x2413 Noble 28)
x2619 Colville 29)
5655 Sibbaldi 30)

[22] John Case, *Angelical Guide, shewing men and women their lott or chance in this elementary life in IV books*, London, 1697.

[23] The British Museum catalogue lists 33 titles under *Dissertatio* and antedating this letter. The most of them deal with the church.

[24] Probably one of the versions of the Tristan saga: by Gast, Paris, 1520, 1533; by Mangin, Lyon, 1577, Paris, 1586; or by Tressen, Paris, 1781, 1787.

[25] Ritson left annotated copies of Sir David Dalyrymple, Lord Hailes' *Annals of Scotland from Malcolm III to Robert I*, and . . . *from Robert I to the House of Stuart*, Edinburgh. See also *Letters*, Vol. II, p. 47.

[26] This perhaps alludes to one of the numerous "Projects" of the time.

[27] Either *A Genealogical History of the Present Royal Families of Europe*, London, 1781, or *Memoirs of the Protectoral House of Cromwell*, 2 vols., London, 1784 and 1787, or both, by Mark Noble (1754–1827). Ritson was interested in royal genealogies and had himself published in 1778, *Tables Shewing the Descent of the Crown of England*. Furthermore, both editions of Noble's second work had been severely criticised by Ritson's friend, Richard Gough, in the preface to his *Short Geneological View of the Family of Oliver Cromwell*, London, 1785, and in the *Gentleman's Magazine*, June, 1787, p. 516. Rison had previously purchased Noble's *Two Dissertations on the Mint and Coins of the Episcopal Palatines of Durham*, Birmingham, 1780. See *Literary Anecdotes*, Vol. VIII, p. 133, note.

[28] *The Poetical Works* of Robert Colvill, minor Scottish poet, appeared at London in 1789.

[29] Sir Robert Sibbald (1641–1712), chiefly noted for his *History of Fife*, wrote a great number of treatises on antiquarian subjects for the Royal Society. These were published in 1739 as *A Collection of several Treatises in folio, concerning Scotlond, as it was of old, and also in later times*. On July 30, 1793, Ritson wrote to Laing for a copy of Sibbald's *Works*, which was to be purchased from the library of James Cumyng, late Secretary of the Society of Antiquaries of Edinburgh. See *Letters*, Vol, II, p. 19.

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Grays Inn, 20th Novr. 1793.

My good friend,

I have purposed writing to you for some time, but as you would have got nothing by it, you will think it just as well perhaps that i 31) have defered my letter till it became productive of some little advantage. I am vexed, at the same time, that i could not write yesterday, as most likely such of the above numbers as i wish most to see are already disposed of. I dare not mention Sibbald, as in the first place i suspect it *not* to be complete, and secondly, i am terrifyed at the idea of your unexpressed & inconceivable charge. You may put up the few articles you send me (if not too late) in Egerton's 32) parcel; & i will pay the charge into your account with them. I will also pay them if agreeable to you, the sum of ten guineas which you will be so good as to pay over to Mr. Allan 33) to whom i write by this post. My book is nearly ready for publication, & will certainly appear by or about Christmas. 34) I have not taken the liberty to put your name to it, for which, i take it, on a perusal of the introduction, you will think yourself not a little obliged to me. 35) I cannot easyly reconcile your assurance of the sale of a number of copies with your indetermination to take one. The expense of sending a parcel to Edinburgh may

---

[31] Ritson's first publication, a group of amatory *Verseës addressed to the Ladies of Stockton*, 1772, exhibited a mode of spelling characterized by discarding the capital *I* except at the beginning of sentences, and by giving all words ending in *e* their full form when suffixes were added. This system he employed in his later publications, expanding it as he gained confidence. Toward the close of his life some of his books were refused by publishers because of orthographic mutilations. That he was by no means consistent in his orthographic practice is evidenced by these letters. See a factitious letter in the *Monthly Mirror* for Aug., 1803, put together by "Old Nick", which ludicrously exposes Ritson's variations.

[32] T. and J. Egerton, London booksellers, published Ritson's *English Anthology*, 1793–4, and *Scotish Songs*, 1794.

[33] George Allan (1736–1800), celebrated antiquary of Darlington, after interesting Ritson in antiquarian study, introduced him to the British Museum. In return Ritson aided Allan materially with some of his publications. See *Letters, passim.*

[34] *Scotish Songs*, 2 vols., London, 1794. This work had been in process of compilation for several years, and in the press for some months, but was not published until the March following this letter.

[35] An introductory "Historical Essay of Scotish Song" contains a strong indictment of the Scottish literati as the world's most notorious forgers. Ritson was as unsparing as Dr. Johnson in his ridicule and condemnation of the Scottish. On one occasion he remarked, "The character given of Scotish men by old surly Johnson was, generally speaking, far from unjust. They prefer anything to truth, when the latter is at all injurious to the national honour: nor are they, so far as I can perceive, very solicitous about it on any occasion". *Letters*, Vol. I, p. 191.

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be no great object, but to have it returned entire is what i should not like: so if you will answer for 50 i will send you 100, if 25, 50, if 10, 20, if 5, 10, if none, not one, *sat verbum.* 36)

I am much obliged to Mr. Brown, 37) & request whenever you meet him you will exert your eloquence in remembering my friendship & respect. I am much chagrined at the fate of my King Charles spurs, which were really curious, 38) as well as at the loss of Mr. Patons parcel. 39) Please to present my best compliments to that worthy man & say that i mean to have the pleasure of writing to him in a little time. I must give up, i find, all expectation of becoming acquainted with the old volume which has given all of us so much trouble. I sometimes think of addressing myself directly to the dean, but "the insolence of office" would most probably prevent him from paying any attention to my request. 40)

Pray why have i never heard anything further of the Edinburgh catalogue? 41) It would be of great use to me in a work i am now amused with; & which i mean to be a kind of a sort of a Scotish 42) library of historians & poets. 43) In this,

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[36] Despite this ultimatum, in March, 1794, Ritson sent Laing 50 copies of the work with the following directions as to their disposal: ". . . twelve you take yourself; five you will present, with the Editor's compliments, to Mr. Fraser Tytler, Mr. Allan. Mr Brown, Mr. Paton, and Mr. Campbell—that is one to each; the rest you will sell on my account,if you can." See *Letters,* Vol. II, p. 47.

[37] Alexander Brown, librarian of the Advocates' Library. See *Letters,* Vol. II, p. 21.

[38] Ritson had sent his rare King Charles' spurs to Cumyng as a gift to the Society. Upon Cumyng's death, early in 1793, his entire library was purchased by Laing. After repeated inquiry Ritson learned that the spurs had been lost in transferring the property. See *Letters,* Vol. II, p. 21ff.

[39] To George Paton (1721–1807), Scottish bibliographer and antiquary, Ritson was greatly indebted for information concerning Scottish history and poetry. A small volume of *Letters from Joseph Ritson, Esq., to Mr. George Paton* was published in 1829 for private circulation.

[40] This refers to 'an old volume of tracts' which Tytler had withdrawn from the Advocate's Library, and from which Ritson wished especially a transcript of the "six first lines of Robin Hood". See *Letters,* Vol. II, pp. 4, 21, and *Archibald Constable and his Literary Correspondents,* 3 vols., Edinburgh, 1873, Vol. I, pp. 505, 509.

[41] Ritson suggested that Laing, who was noted for his catalogues, make a complete compilation of books published in Scotland, and offered his own ideas as to the best method of procedure. See *Letters,* Vol. II, pp. 38, 48.

[42] For Ritson's spelling of 'Scotish' see my note in *Notes and Queries,* Ser. 11, Vol. XI, p. 306.

[43] The MS. of this work, never published, was described in the Ritson sale catalogue as follows: "Bibliographia Scotica, Anecdotes Biographical and Literary of Scotish Writers, Historians, and Poets, from the earliest accounts to the nineteenth century, in two parts, intended for publication". It was intended to supplement *Bibliographia Poetica: A Catalogue of English Poets, of the Twelfth, Thirteenth, Fourteenth, Fifteenth, and Sixteenth Centurys, with a short account of their works,* London, 1802.

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which i think i must come down to finish & print in Edinburgh, you would be of no little service. Who or what is Robert Colvelle? Can you get me the two (or more) poems he has published?

I am,
Your sincere friend &
well-wisher,
J. RITSON.

Mr. Wm. Laing,
Bookseller,
Chessel's Buildings
Canongate
Edinburgh.

The four letters forming the following group are addressed to George Chalmers (1742–1825), Scottish antiquary, author of *Caledonia,* and life long friend of Ritson. They are concerned mainly with the borrowing of books from Chalmers' library. The volumes asked for in the first letter—sixteenth century grammars and orthographies—were of interest to Ritson because he was at this time working on his own scheme of grammar and orthography. As a result of his labors with these and other books, he left in manuscript at his death: "Dissertation on the use of 'Self,'" "An orthographico-etymological dictionary of the English language," and "Gleanings of English grammar, chiefly with a view to illustrate and establish a just system of orthography, upon etymological principles." From the transcript of the Stationers' Register, with which the remaining letters of the group are concerned, Ritson gleaned much material for his *Bibliographia Poetica,* and many songs and ballads for his various collections. He left a manuscript of "Extracts of entries (chiefly of songs and ballads) in the Stationers' books, from a transcript by the late W. Herbert."

MS. Montagu d. 15, fol. 216, 218.

1. Derickes Image of Ireland, 1581. 44)

[44] John Derricke's *Image of Ireland,* in two parts, written in 1578, published 1581, was reprinted with notes by Sir Walter Scott in *Somers' Tracts,* 1809, and a limited edition was put out by John Small in 1883. The full title of this book, containing 153 words, is given in *Bibliographia Poetica,* pp. 186–7. See also *Letters,* Vol. II, p. 148.

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2. Bellots English Schoolmaster, 1579. 45)
3. Bullokars Orthographie, 1580. 46)
4. Mulcasters Elementarie, 1582. 47)
5. Grammatica Anglicana, 1594. 48)
6. Spensers Three Letters, 1590. 49)
7. Blages Wise conceytes, 1569. 50)

Dear Sir,

If the books mentioned in the enclosed paper be in your own library, as I presume they are, I shal be highly gratifyed by the perusal of such of them as you can conveniently spare. They shal be treated with care, & returned with expedition.

Yours respectfully

J. RITSON

Monday, 6th Feb.
1797.
George Chalmers, esq.

Add. Mss. 22900, fol. 404.
Dear Sir,

Understanding that you have purchased Mr. Herbert's 51) transcript of the Stationers-books, I presume upon your experienced liberality to solicit the loan, for a few days, of

[45] The only copy known to exist of Jacques Bellot's *The Englishe Scholemaister: Conteyning many profitable precepts for the naturall borne French men, and other straungers that have their French tongue to attayne the true pronouncing of the Englishe tongue*, London, 1580, is that preserved at the Hofbibliothek in Darmstadt. It was edited, with a reproduction of the original title page, by Theo. Spira, as Vol. VIII of *Neudrücke frühneuenglischen Grammatiken*, Halle, 1912.

[46] William Bullokar published, in 1580, *Booke at Large for the Amendment of Orthographie for English Speech*. This was followed by two other books dealing with similar subjects. All three were published by Max Plessow in *Geschichte der Fabeldichtung in England bis zu John Gay*, Berlin, 1906.

[47] Richard Mulcaster, *First Part of the Elementarie, which entreateth chefelie of the right Writing of our English Tung*, London, 1582. No second part is known to have appeared; the first has not been reprinted.

[48] *Grammatica Anglicana, praecipué quatenus à Latina differt, ad unicam P. Rami methodum concinnata, etc.*, London, 1594, Hrsg. von M. Rösler und R. Brotanek. Announced in 1905 for publication in *Neudrücke frühneuenglischen Grammatiken*, but it has not yet appeared.

[49] Edmund Spenser, *Three proper and wittie, familiar letters: lately passed between two university men: touching the earthquake in April last, and our English reformed versifying*, London, 1580.

[50] Thomas Blage, *A Schole of Wise Conceytes, set forth in common-places by order of the alphabet. Translated out of divers Greeke and Latine wryters*, London, 1569.

[51] William Herbert (1718–1795), noted chiefly for his edition of Ames' *Typographical Antiquities*, 1785ff. Ritson furnished his own copy of this work with 'a great number of MS. notes and remarks'.

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the first volume, either now or when you can better spare it; with liberty, if you please, to extract such entries of ballads as Herbert has not already printed. 52)

I am, Dear Sir,
Very respectfully & sincerely yours
J. RITSON.

Gray's-Inn,
15th. Dec. 98.
George Chalmers esquire,
Green-street.

Ms. Montagu d. 15, fol. 220.

Grays-inn, 20th Decem. 1798.

Dear Sir,

I return your first volume, with a thousand thanks, and flatter myself it has not been detained beyond your expectation. As you appear not to have finished your examination of the second, perhaps you could part with it more conveniently at a future time, for which I should wait with pleasure. If, however, the present be equally agreeable, you may rely on the utmost dispatch from,

Dear Sir,
Very sincerely yours,
J. RITSON.

P. S. "The Clarkes book", I perceive, wch contained the entrys from 22d July 1571 to 1576, is still missing; nor now likely, I conclude, ever to be found. Another book, with a white cover, occasionally refer'd to, is, doubtless, in the same predicament.

George Chalmers esquire, Green-street.

Add. Mss. 22901. fol. 13.

Dear Sir,

I return to you the concludeing volumes of Mr. Herberts transcript, & shall ever retain the most grateful sense of so considerable a favour.

Upon Mr. Steevens's application to I know not what members of the stationers company, they agreed to let me have the use of these books in their own hall, but had determined, it seems,

[52] In his edition of Ames.

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that they should no more go abroad into private hands. 53) As the terms were inconvenient, I did not accept the offer; & have thereby had an opportunity of being much more pleasceingly indebted to your superior liberality.

I remain, Dear sir,
Your most obliged & respectful
humble servant,
J. RITSON.

Grays-inn,
29th Jany. 1799.

The final letter presents Ritson's views on some of the problems connected with the romance of "Sir Tristrem." It was written three years before the appearance of Scott's edition of the romance, in 1804, and thus antedates the critical controversy over the authorship of the poem which was precipitated by the announcement of Scott's conclusions in the Introduction. From this letter it appears that Ritson had independently arrived at practically the same conclusions, that he had estimated the age and origin of the poem, and that he had stated the most plausible theory yet advanced for a definite authorship of it, and supported his theory by all the available internal and by almost all the corroborative external evidence which the subsequent century of scholarly investigation has sufficed to unearth.

To the question of the authorship of "Sir Tristrem" there has not been, and probably can never be, a definite answer. The theory held by Ritson and propounded by Scott, that the 'Thomas' mentioned in the first lines of the romance was in all probability its author, was too simple to go long unchallenged. In their anxiety to prove all things scholars have explored the hidden, labyrinthian paths and have been prone to ignore the plain and straight ways, if for no other reason than because they were obvious. And so, after Scott's declaration that "the Romance of *Sir Tristrem* was composed by THOMAS OF ERCELDOUNE called the RYHMER, who flourished in the thirteenth century," came the testimony of such men as Price,

[53] Steevens' interest in procuring these books for Ritson came as a result of his suggestion that the antiquary undertake a catalogue of English poets of the early centuries—which was published as *Bibliographia Poetica*. Their cooperation in this regard is evidence that editorial controversy did not cut Ritson off entirely from the men he criticised.

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Wright, Paris, Hazlitt, Halliwell, Garnett, Murray, Schofield, and Kölbing to prove—not that some other person was the author of the poem, but simply that Thomas was *not* its composer. In McNeill, the latest editor of the romance, critical judgment seems to be swinging back to the common-sense position taken by Ritson and Scott. After reviewing carefully the evidence and the arguments in favor of an unknown author other than Thomas of Erceldoune, McNeill concludes thus: "Broadly viewed, the question of the authorship of the poem is one which, from the nature of the evidence, must be answered in accordance rather with reasonable probability than with absolute demonstration; and the reasonable probability is that Robert Mannyng of Brunne was right when he ascribed the poem to Thomas of Erceldoune." 54)

Ritson's letter bears no address. Until its recipient is definitely determined, it cannot be known just what was the degree of Scott's indebtedness to his friend's research, if, indeed, he owed anything at all to it. There is but one reference to Ritson in Scott's Introduction, and that is a statement of his suggestion that Thomas may have assumed the third person so as to gain the greater authority of the reputation of his own name for what he was writing—an opinion not specifically expressed in this letter. Only one student of "Sir Tristem" seems to have been cognizant of the existence of this letter. Mätzner gives Ritson credit for being the first to discover the romance in the Auchinleck manuscript. 55)

Ms. Laing II. 589.
Dear Sir,

The romance of Sir Tristrem, if admitted to be the production of Thomas of Ercildon, i may be well enough said to have discovered, as i know of none who had anticipated my conjecture though i have not been permited to announce that discovery myself. 56) It is extant in a most valuable, but shock-

[54] G. P. McNeill, *Sir Tristem*, Edinburgh and London, 1886, p. xliv.

[55] Eduard Mätzner, *Altenglische Sprachproben*, Berlin, 1867, Vol. I, p. 233.

[56] There are two possible reasons why Ritson had not been 'permitted' to announce his discovery. The first is the state of his health, which, at the time of this letter, was such that he had for five years done no publishing and very little literary work of any kind. Secondly, his knowledge that Scott, whom he held in very high esteem, was preparing an edition of the romance might probably have operated to keep him from publishing his own material. See *Letters*, Vol. II, pp. 217, 222, 228, 232, 237.

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ingly mutilated, MS. in the library of the faculty of advocates at Edinburgh, marked W. 4. 1. and presented to the late lord Auchinleck in 1744; its age to the best of my judgment, being about the year 1400, 57) and, evidently compiled and written in England. 58) The reasons from which i infer this imperfect romance to be the work of the ancient Scotish bard already mentioned are these: Robert of Brunne, in the prologue to his metrical version of Peter Langetoft, says, 59)

"I see in song in sedgeyng tale
Of *Erceldoun*, & of Kendale,
Non þam says as þai þam wrought,
& in þer sayng it semes noght.
þat may þou here in *Sir Tristrem*,
Ouer gestes it has þe steem,
Ouer all þat is or was.
If men it sayd as made *Thomas*.

But I here it no man so say,
þat of some copple is away.
So þarefare sayng her beforne,
Is þare trauayle nere forlorne.

. . . .

þai sayd in so *quaynte Inglis*,
þat many one wote not what is,
þerfore heuyed wele þe more
In *strange ryme* to trauayle sore."

I shall now proceed to gratify your curiosity, by a transcript of the first stanza, which will serve at the same time, to illustrate the censure of the English critick, and to ascertain the title of the Scotish poet. It runs thus:

"I was at *Ercildoun* (To supply by conjecture, what is illegible)
Wiþ Thomas spak y þare.
þer herd y rede in roune,
Who Tristrem gat & bare,

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[57] Scot was more nearly right in referring the MS. to "the earlier part of the fourteenth century'. See also McNeill, who places it at the beginning, and Murray, who sets it at the middle, of the century.

[58] On this point there is no difference of opinion. Ritson agreed that the English version was from a Norman or Anglo-Norman source. He frequently contended, as did Tyrwhitt and Warton, that there exists no English romance which is not derived, directly or indirectly, from a French original. See 'Observations on the ancient English minstrels', prefixed to *English Songs and Ballads*, London, 1790, and 'A dissertation on romance and minstrelsy', in *Ancient Engleish Metrical Romanceës*.

[59] ll. 93–104. Scott also quotes these lines.

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Who was king wiþ croun,
  And who him fostered ƒare.
And who was bold baroun,
  As þair elders ware
    Bi ƒere:
Tomas telles in toun
  þis aventours as þai were."

This is a specimen of such "quaynte Inglis," and such "strange ryme," as there is no other instance of; and, with the other extracts i have made from this venerable relique 60) (which, by the way, i had neither time nor convenience to transcribe at length), sufficiently proves, at least to my own conviction, that this is the identical poem alluded to in the above passage of Robert Mannyng. In further support of the authorship, i can also cite the fragment of an ancient romance in French metre upon the same subject, in the possession of Mr. Douce, 61) in which the Scoto-English performance is apparently criticised under the name of *Thomas*. 62) The objection made, by some, against this opinion, is, that the poem speaks of *Thomas*, in the *third* person, as one from whom he states himself to have received his materials: but for this singularity (if it be one), the authors caprice must be responsible. It seems, in fact, to have been, if not the peculiar, at least the notorious practice, of this popular rimer: as, in two more modern poems, always ascribed to, but not, i believe, actually writen by him, he is introduced in the same manner: one of these mentioned by Lord Hailes, you most probably have in the Scotish prophecys, the other, an imperfect MS. in the Cotton library, & Lincoln cathedral, has not been printed. 63) Beside, Maistre Wace, more than once, speaks of himself in the same manner, tho' at other times in the first person; and this identical objection is alledged, by Bishop Watson, against the cavils of

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[60] They seem not to have been used.

[61] Francis Douce (1757–1834) aided Ritson in the preparation of *Bibliographia Poetica* and then became estranged from him because of the shabby treatment he received.

[62] The Douce fragments were edited by Francisque Michel, *Tristan: recueil de ce qui rest des poëmes relatifs à ses aventures composés en François, en Anglo-Normand, et en Grec dans les xii et xiii siècles*, 2 vols., London, 1835, and described by A. E. Curdy, *La Folie Tristan, an Anglo-Norman poem*, Baltimore, 1902. Scott cited extracts from the fragments (Introduction pp. 42–4) in support of the point Ritson here makes.

[63] It was printed by David Laing as 'Tomas of Ersseldoune', in *Early Popular Poetry of Scotland*, revised edition, London, 1895, pp. 81–111.

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Thomas Paine, as a strong argument in favour of the four evangelists, after the example of Caesar, Xenophon, and other ancient historians: 64) which is all i have at present to say upon the subject. I understand however, that some gentlemen, at Edinburgh, have transcribed the entire poem for the purpose of publication, which i should, in fact, have done myself, tho' without the like advantages, had it not been mutilated and imperfect. 65)

I put into your hands a few years ago an alphabetical list of the names of British rivers, which, if it would be of any service to you, and has already performed it, i should be obliged to you to leave for me at Egertons any time it may be convenient. 66)

I am,
Dear Sir,
Very respectfully & sincerely yours,
J. RITSON.

Grays inn,
26th June 1801.

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[64] Richard Watson, *Apology for the Bible, in Letters to Thomas Paine*, London, 1796.

[65] This, in all probability, alludes to the copy which formed the basis of Scott's edition. Ritson's veneration for Scott seems to have led him to underestimate his own ability as a transcriber. Had he copied the whole poem for publication, it would certainly not have been less perfect than Scott's version, which, according to Kölbing, 'swarms with errors'. He was remarkably painstaking and accurate in such matters. Scott was not, and he often, as perhaps in the case of "Sir Tristrem", left the copying to be done by a hired clerk. See E. Kölbing, *Die nordische und die englische Version der Tristan-sage*, Heilbronn, 1878–82.

[66] This unpublished MS. is now Douce 340, in the Bodleian Library: "A list of river names in Great Britain and Ireland, with a few etymological notes on them."

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A SPECIES LIST OF THE APHIDIDAE OF THE WORLD AND THEIR RECORDED FOOD PLANTS

By H. F. Wilson
AND
R. A. Vickery

PREFACE

The *Aphididae,* aside from their great economic importance, are very interesting objects for observation and their peculiar life histories and habits, both above and below ground, give added zest to the study of this insect group.

The evidence before us shows that the majority of species of aphids are confined to certain definite food plants, and the determination of any one species is made more easy when the food plant upon which it occurs is known.

Realizing this to be true the following paper has been compiled. We realize that additional valuable data might have been included and a catalog prepared, but such was not the object in mind. We have purposely omitted all attempts at synonomy for both genera and species because we feel that the existing chaotic condition in this group can be better taken care of in a paper dealing with those phases alone. It is hoped that such a paper may be issued in the near future. No names given as trinomials have been included in this paper.

No doubt a more up-to-date selection of generic names might have been used, and some inconsistencies are known to be present. During the past few years a great activity has been taking place in the breaking up of the old groups to form new ones and many generic names have been provided which will probably not withstand a revision. We have therefore taken the liberty to select older names except in cases where the new species form

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types of new genera or where generic names recently changed will probably stand.

For the plant names the Index Kewensis compiled by B. Daydon Jackson has been used. A great many names listed as synonyms in that publication are now generally accepted and in such cases the names now in use are underlined and followed by the names recognized by Jackson. For example,—Acer negundo = Negundo aceroides, which indicates that Acer negundo is now generally in use while Negundo aceroides was the name accepted by Jackson.

Names in quotation marks are common names or else could not be located in the Index Kewensis. Generic names followed by specific names within quotation marks indicate that the specific names may occur several times with different synonyms.

Among the abbreviations used occur some which are familiar to aphidologists but may not be to others. To make these clear a complete citation of these follows.

APHIDIDAE ITALICA (Passerini) 1863—Archives per la Zoologia l'anatomia e la fisiologia, Vol. II, Fasc. 2.

HEMIPTERA OF COLORADO (Cowen) 1895—(A Preliminary List of the Hemiptera of Colorado)—Colorado Agricultural Experiment Station Bulletin No. 3, Technical Series No. 1.

KANSAS APHIDIDAE (Sanborn) 1904—(Kansas Aphididae with catalog of North American Aphididae and with Host-Plant List). The Kansas University Science Bulletin, III, No. 1. (Whole series, Vol. XIII, No. 1).

APHIDIDAE OF MINNESOTA (Oestlund) 1886—(List of the Aphididae of Minnesota with descriptions of new species)—Fourteenth Annual Report, Geological and Natural History Survey of Minnesota.

APHIDIDAE OF MINNESOTA (Oestlund) 1887—Synopsis of the Aphididae of Minnesota)—Geological and Natural History Survey of Minnesota, Bulletin 4.

APHIDIDAE OF NEBRASKA (Williams), 1911,—(The Aphididae of Nebraska)—University of Nebraska Studies X, No. 2. Supposed to have been published in 1910 but apparently was not issued until 1911. The species described as new in this paper were originally listed as new species in Special Bulletin, No. 1 from the University of Nebraska Department of Entomology, published in 1891. No description accompanied the names.

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RAB. LAB. ZOOL. KAB. VARCH. UNIV. (Mordwilko)—The Fauna and Anatomy of the Aphididae)—Work of the Laboratory of the Zoological Cabinet, Imperial University of Warsaw (literal translation). Published in several parts in 1894 and 1895. A table of species was given in 1894 but the species were not described until 1895. The title of the publication in which these papers appeared as secured for us by Mr. J. J. Davis is "Varshava Universitskiia Izviestiia."

REPT. NOX. & BEN. INSECTS N. Y. (Fitch)—Reports on the Noxious, Beneficial and other insects of the state of New York)—Transactions N. Y. State Agricultural Society.

Mr. J. J. Davis, Mr. L. G. Gentner and Mr. C. L. Fluke have been exceedingly kind in helping check data, reading proof, etc.

Mrs. M. Fischer Hildreth has also given much assistance in copying the manuscript.

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A SPECIES LIST OF THE APHIDIDAE OF THE WORLD AND THEIR RECORDED FOOD PLANTS

PART I

A SPECIES LIST OF THE APHIDIDAE OF THE WORLD WITH THEIR RECORDED FOOD PLANTS

PART II

A LIST OF APHID FOOD PLANTS AND THE APHIDS SAID TO ATTACK THEM

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PART I

A SPECIES LIST OF THE APHIDIDAE OF THE WORLD WITH THEIR RECORDED FOOD PLANTS

An * indicates that we have been unable to verify the citation. A generic name following a citation indicates the name under which that species was first described. Example Aphis.

abameleki, Eulachnus Del Guercio, 1909. Redia, V. p. 329, fig.
Pinus pinea, P. sylvestris.

abbreviata, Aphis Patch, 1912. Me. Agr. Exp. Sta. Bul. 202, p. 170, fig.
Alisma plantago.

abietaria, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1035. No food plant given. *(Abies?)*

abieticola, Lachnus Cholodkovsky, 1899. Zool. Anz. XXII, p. 470, fig.
Picea alba, P. mariana, Abies sibirica.

abieticolens, Chermes Thomas, 1879. Eighth Rept. State Ent. Ill., p. 156.
Picea sp.

abietina, Myzaphis (Walker), 1849. Ann. Mag. Nat. Hist., ser. 2, III, p. 301. Aphis.
Picea abies, P. alba, P. engelmannii, P. gigantea, P. glehire, P. kosteriana, P. mariana, P. monstrosa, P. morinda, P. omorika, P. orientalis, P. rubra, P. pungens, P. sitchensis.

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abietinus, Mindarus Koch, 1857. Die Pflanzenläuse Aphiden, p. 278, fig.
Abies nordmanniana, A. pectinata, Picea abies, P. canadensis, P. mariana.

abietis, Lachnus (Walker), 1848. Ann. Mag. Nat. Hist., ser. 2, II, p. 100. **Aphis.**
Picea abies?

abietis, Chermes Linnaeus, 1758. Edition 10 Systema Naturae, p. 454.
Larix decidua, L. sibirica, Picea abies, P. alba, P. mariana, Pinus cembra, P. sylvestris.

abietis, Lachnus Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 67.
Abies concolor, A. sibirica, Picea abies, P. alba, P. canadensis, P. mariana.

abietis-laricis, Chermes Stebbing, 1903. Jour. Asiat. Soc. Bengal, LXXII, part 2, p. 57.

abietis-piceae, Chermes Stebbing, 1903. Jour. Asiat. Soc. Bengal, LXXII, part 2, pp. 57–60, pl. 1.
Abies webbiana, Picea morinda.

abrotani, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1035.
No Food plant given.

abrotani, Hyalopterus Koch, 1854. Die Pflanzenläuse Aphiden, p. 18 fig.
Artemisia abrotanum, A. vulgaris.

absinthii, Macrosiphum Linnaeus, 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Achillea ligustica, A. millefolium, Artemisia abrotanum, A. absinthium, A. variabilis, A. vulgaris, Helichrysum angustifolia.

absinthii, Rhopalosiphum Lichtenstein, 1885. Bul. Soc. Ent. France, ser. 6, V, p. CXLI.
Artemisia absinthum.

acaenae, Rhopalosiphum Schouteden, 1904, Erg. Hamb. Magalh. Sammelr. (1) Sieb. Lief., 7, p. 1. We have seen separate only.
Acaena splendens.

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acanthi, Aphis Schrank, 1801. Fauna Boica, II, p. 122.
Cirsium arvense, Cnicus oleraceus.

acanthochermes, Phylloxera Lichtenstein, 1876. Ann. Soc. Ent. France, ser. 5, VI, p. XCV.
Quercus robur.

acaroides, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic Rev. III, p. 17.
Lepidium virginicum.

acericola, Aphis Walker, 1848. Ann. Mag. Nat. Hist., ser. 2, I, p. 451.
Acer pseudo-platanus, Platanus sp.

acerifoliae, Drepanaphis (Thomas), 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 4. Siphonophora.
Acer saccharinum, A. saccharum.

acerifolii, Pemphigus Riley, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 16.
Acer saccharinum.

acerina, Drepanosiphum (Walker), 1848. Ann. Mag. Nat. Hist., ser. 2, I, p. 254. Aphis.
Acer campestre, A. platanoides, A. pseudo-platanus.

aceris, Chaitophorus (Linnaeus), 1761. Fauna Suecica, p. 262. Aphis.
Acer campestre, A. mospessulanum, A. negundo, A. opulifolium, A. pennsylvanicum, A. platanoides, A. pseudo-platanus, A. tataricum, Aesculus parviflora.

aceris, Drepanosiphum Koch, 1855. Die Pflanzenläuse Aphiden, p. 202, fig.
Acer campestre.

aceris, Pemphigus Monell, 1883. Can. Ent. XIV, p. 16.
Acer saccharum.

acetosae, Aphis Linnaeus, 1767. Edition 12, II, p. 734.
Rumex acetosa.

acetosae, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 80. fig.
Rumex acetosa, R. conglomeratus.

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achilleae, Macrosiphum (Fabricius), 1776. Genera Insectorum, p. 385. **Aphis.**
Achillea millefolium.

achilleae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 159, fig. **Aphis.**
Achillea millefolium.

achyrantes, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 18. **Siphonophora.**
Achyrantes sp., Alyssum maritimum, Amaranthus sp., Asparagus plumosus, Gladiolus sp., Malva parviflora.

aconiti, Rhopalosiphum Van Der Goot, 1912. Tijdschr. voor Ent. deel LV, p. 73.
Aconitum napellus.

***aculeata, Glyphina** Dahl, 1912. Beitr. Naturdenkmalpfl III, p. 434. Food plant?

addita, Aphis Walker, 1849. The Zool. VII, p. 33, app.
Malva sylvestris.

adducta, Aphis Walker, 1849. The Zool. VII, p. 34, app.
Tilia rubra.

adianti, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 26.
Adiantum pedatum.

adjecta, Aphis Walker, 1849. The Zool. VII, p. 46, app.
Lycopsis arvensis, Cynoglossum officinale.

adjucta, Aphis Walker, 1848. The Zool. VI, p. 2220.
Lycopsis arvensis.

adjuvans, Aphis Walker, 1848. The Zool. VI, p. 2220.
Lycopsis arvensis.

adscita, Aphis Walker, 1848. The Zool. VI, p. 2220.
Lycopsis arvensis.

adusta, Aphis Zehntner, 1897. Archief Java Suiker Ind., V, p. 552.
Saccharum officinarum.

advena, Aphis Walker, 1849. The Zool. VII, p. 48, app.
Sambucus nigra.

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aegopodii, Siphocoryne Scopoli, 1763. Entomologia Carniolica, p. 137. **Aphis.**
Aegopodia podagraria, Salix sp.

affinis, Aphis Del Guercio, 1911. Redia, VII, p. 315.
Mentha viridis.

affinis, Aphis Del Guercio, var. **gardeniae,** Del Guercio, 1913. Redia, IX, p. 160, fig.
Gardenia radicans.

affinis, Cnaphalodes Börner, 1908. Arb. Kaiserlichen Biol. Ans. Land-und Forstw., VI, part 2, p. 167.
Larix decidua, Picea abies, Pinus sp.

affinis, Thecabius (Kaltenbach), 1843. Mon. der Pflanzenläuse, p.18. **Pemphigus.**
Populus monilifera, P. nigra, P. pyramidalis, Ranunculus acris, R. bulbosus, R. flamula, R. repens.

africana, Aphis Theobald, 1914. Bul. Ent. Research IV, p. 330, fig.
(Sorghum vulgare, Hordeum vulgare.)?

africana, Tetraneura Van Der Goot, 1912. Mitteilungen aus dem Naturhistorischen Museum. XXIX. p. 282.
(Prunus amygdalus)?

ageratoidis, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 38.
Eupatorium ageratoides, E. urticaefolium.

agilis, Lachnus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 161.
Pinus halepensis, P. pinaster, P. sylvestris.

agrimoniella, Macrosiphum (Cockerell), 1903. Can. Ent., XXXV, p. 168. **Nectarophora.**
Agrimonia eupatoria.

agropyronensis, Chaitophorus Gillette, 1911. Ent. News, XXII, p. 442.
Agropyron glaucum.

agrostemnium, Macrosiphum Theobald, 1913. nov. nom. for **Siphonophora cichorii,** Buckton (part) non. Koch. Jour. Econ. Biol., VIII, No. 3, p. 146.
Agrostemma githago.

ajugae, Myzus Schouteden, 1903. Ann. Soc. Ent. Belg., XLVII, p. 194.
Ajuga genevensis, A. reptans.

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alaterni, Toxoptera Del Guercio, 1909. Rivista di Pat. Vegetale, IV, p. 10.
Rhamnus alaternus.

alba, Tetraneura (Ratzeburg), 1844. Die Forst-Insecten, III, p. 222. **Aphis.**
Ulmus campestris.

albasiphus, Symdobius Davis, 1914. Can. Ent. XLVI, p. 226, fig.
Quercus alba.

albicornis, Amycla Koch, 1857. Die Pflanzenläuse Aphiden, p. 305, fig.
Polygonum sp.

albifrons, Macrosiphum Essig, 1911. Pom. College Jour. Ent. III, p. 543, fig.
Lupinus albifrons.

albipennis, Schizoneura Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1051.
Food plant not given.

albipes, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 52.
Symphoricarpos orbiculatus, S. racemosa, S. occidentalis.

alboapicalis, Siphocoryne Theobald, 1916. The Entomologist XLIX, p. 182, fig.
Malva sp.

albus, Chaitophorus Mordwilko, 1901. Horae Soc. Ent. Ross. XXXIII, p. 410.
Populus sp.?

alemedensis, Aphis Clarke, 1903. Can. Ent. XXXV, p. 251.
Prunus domestica.

alienus, Aphis Theobald, 1913. The Entomologists Record, XXVII, p. 54.
In nest of **Lasius alienus.**

alismae, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 26. No description.
Alisma plantago.

alleghenіensis, Lachnus McCook, 1877. Trans. Amer. Ent. Soc., VI, p. 274, fig.
Quercus sp.

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alliariae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 160, fig. **Siphonophora.**
Lactuca macrophylla, L. scariola, Lapsana communis, Sisymbrium alliaria, S. officinale, Sonchus oleraceus.
Probably Linn. was meant for Koch as Koch refers the species to Linnaeus in the subject matter.

alliariae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 177, fig. **Siphonophora.**
No food plant with the original description.
Sisymbrium alliaria, S. officinale.

allii, Aphis Lichtenstein, 1884. La Flore des Aphiden, p. 11. No description.
Allium sp.

alni, Myzocallis DeGeer, 1773. Memoires des Insects, III, p. 47, fig. **Aphis.**
Alnus glutinosa, A. rhombifolia.

alni, Chermes Kalm, 1770. Travels in North America (English Translation), I, p. 154.
Alnus sp.

alni, Glyphina (Schrank), 1801. Fauna Boica, II, p. 107. **Aphis.**
Alnus incana, A. glutinosa, Betula alba.

alni, Pemphigus Provancher, 1890. Petite Faune Ent. Can. III, p. 320.
Alnus sp.

alnifoliae, Myzocallis (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 67. **Lachnus.**
Alnus rubra, A. rugosa.

alnifoliae, Pemphigus Williams, 1911. Aphididae Nebraska, p. 7.
Amelanchier alnifolia. A. spicata.

alter, Symdobius Mordwilko, 1908. L'ann. de Musee Zool. L'Acad. Imperial des Sciences de St. Petersburg, XIII. p. 378.
Betula alba.

alterna, Aphis Walker, 1849. The Zool. VII, p. 43 app.
Salix caprea.

althaea, Aphis Harris, 1776. Exposit. Eng. Ins., p. 66, fig. Identification of insect is not clear.

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ambrosia, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic, Rev., III, p. 17.
Ambrosia psilostachya.

ambrosiae, Macrosiphum (Thomas), 1877, Ill. State Lab. Nat. Hist., Bul. 2, p. 4. **Siphonophora.**
Ambrosia psilostachya, A. trifida, Iva xanthifolia, Rudbeckia sp., Rubus villosus.

amenticola, Aphis Kaltenbach, 1874. Die Pflanzenfeinde, p. 586.
Populus sp., Salix alba.

americana, Eriosoma (Riley), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 4, fig. **Schizoneura.**
Ulmus americana.

americanus, Pemphigus Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1057.
Food plant not given. *(Pyrus malus)?*

amerinae, Aphis Hartig, 1841. Zeit. Ent., (Germar) III, p. 369.
Food plant not given.

amica, Aphis Walker, 1848. The Zool. VI, p. 2218.
Artemisia maritima.

ampelinus, Rhizoctonus Mokrzhetsky, 1896 (1897). Horae Soc. Ent. Ross. XXX, p. 438.
Vitis vinifera?

ampelophila, Aphis Del Guercio, 1913. Redia, IX, p. 157, fig.
(Vines) Sambucus sp?

ampelorhiza, Schizoneura Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir., II, p. 104.
Vitis vinifera.

ampullata, Amphorophora Buckton, 1876. Mon. Brit. Aphides, I, p. 187, fig.
Asplenium sp., Cystopteris montana, Onoclea struteopteris, Polystichum sp.

amycli, Tychea Koch, 1857. Die Pflanzenläuse Aphiden, p. 300, fig.
Triticum dicoccum. "Emers"

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amygdali, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 104, figs. A new name for **Aphis persicae Boyer.**

amygdali, Aphis Blanchard, 1840. Hist. Nat. Ins., III, p. 206.
Prunus amygdalus.

amygdali, Dryobius Van Der Goot, 1912. Mitteilungen aus dem Naturhistorischen Museum, XXIX, p. 280.
Prunus sp.

amygdalinus, Aphis Schouteden, 1905. Broteria, IV, p. 163.
Prunus amygdalus?

angelicae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 52, fig.
Angelica sylvestris, Arctium lappa, Cicuta virosa, Hedera Helix.

angelicae, Syphocoryne Del Guercio, 1911. Redia, VII, p. 328, fig.
Angelica sylvestris, Artemisia absinthium.

annuae, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 43.
Echinochloa crus-galli, Poa annua, Poa compressa.

annulatus, Aphis Hartig, 1841. Zeit. Ent., (Germar), III, p. 369.
Quercus sp.

annulatus, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 7, fig.
Betula alba, B. nigra.

annulipes, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic Rev., III, p. 17.
Hieracium gronovii, H. paniculatum.

anonae, Trichosiphum Pergande, 1906. Ent. News, XVII, p. 207.
Anona muricata.

antennata, Monaphis (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 115. **Aphis.**
Betula alba.

antennatum, Melanoxantherium, Patch, 1913. Me. Agr. Exp. Sta. Bul. No. 213, p. 87, fig.
Salix sp.

antirrhinii, Macrosiphum (Macchiati), 1883. Bul. Soc. Ent. Ital., XV, p. 228. **Siphonophora.**
Antirrhinum majus.

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anthrisci, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 112.
Anthriscus sylvestris, A. vulgaris, Chaerophyllm tremulum, Pimelia sp.

aparines, Aphis Fabricius, 1775. Systema Entomologiae, p. 735.
Galium aparine.

aparines, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 46.
Galium aparine, G. mollugo, Papaver sp.

apocyni, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 97, fig.
Apocynum androsaemifolium, A. cannabinum, Ononis natrix.

apposita, Aphis Walker, 1850. The Zool. VIII, p. 103, app.
Senicio vulgaris.

aquatica, Siphocoryne Gillette and Bragg, 1916. Ent. News, XXVII, p. 447, fig.
Catabrosa aquatica.

aquaticus, Aphis Jackson, 1908. Ohio Naturalist VIII, p. 243, fig.
Nymphaea sp.

aquilegia-canadensis, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic Rev., I, p. 361.
Aquilegia vulgaris.

aquilegia-flavus, Hyalopterus (Kittel), Hayhurst, 1909. Jour. N. Y. Ent., Soc. XVII, p. 107.
Aquilegia vulgaris.

aquilegiae, Hyalopterus Koch, 1854. Die Pflanzenläuse Aphiden, p. 19, fig.
Aquilegia vulgaris.

aquilegiae, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 2, p. 92.
Aquilegia vulgaris.

arabis-mollis, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic Rev., III, p. 17.
Arabis canadensis.

aralis-hispida, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic Rev., II, p. 360.
Aralia hispida.

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arbuti, Aphis Ferrari, 1873. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 228.
Arbutus unedo?

arbuti, Rhopalosiphum Davidson, 1910. Jour. Econ. Ent., III, p. 378.
Arbutus menziesii.

archangelicae, Aphis Scopoli, 1763. Entomologia Carniolica, p. 137.
Angelica archangelica, Archangelica sp.

archangelicae, Siphocoryne Oestlund, 1886. Aphididae of Minnesota, p. 36.
Angelica atropurpurea.

***armata, Aphis** Hausmann, 1802. Mag. Ins. Illiger, p. 439.
Digitalis purpurea, papaver sp.

armoraciae, Aphis Cowen, 1895. Hemiptera of Colo., p. 117.
Radicula armoracea.

artemisiae, Aphis Passerini, 1860. Gli Afidi, p. 35.
Artemisia absinthium, A. campestris, A. vulgaris.

artemisiae, Chaitophorus Gillette, 1911. Ent. News, XXII, p. 443, fig.
Artemisia dracunculoides.

artemisiae, Cryptosiphum Buckton, 1879. Mon. Brit. Aphides, II, p. 145, fig.
Artemisia vulgaris.

artemisiae, Macrosiphum (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 162. **Aphis.**
Achillea millefolium, A. nobilis, Althaea officinalis, Artemisia abrotanum, A. absinthium, A. variabilis, A. vulgaris, Chrysanthemum balsamita, C. leucanthemum, Tanacetum vulgare.

artemisiae, Macrosiphum Boyer de Fonscolombe. **var. citrinum,** Schouteden, 1901. Ann. Soc. Ent. Belg., XLV, p. 117.
Artemisia vulgaris.

artemisiae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 165, fig. **Siphonophora.**
Artemisia campestris, A. vulgaris.

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artemisiae, Macrosiphum (Cowen), 1895. Hemiptera of Colo., p. 123. **Nectarophora.**
Artemisia tridentata.

artemisiae, Siphocoryne Del Guercio, 1913. Redia, IX, p. 178, fig.
Artemisia campestris.

artemisicola, Aphis Williams, 1911. Aphididae of Nebraska, p. 37.
Artemisia cana.

artemisicola, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 73. **Siphonophora.**
Artemisia cana, Cirsium lanceolatum.

artocarpi, Greenidea (Westwood), 1890. Trans. Ent. Soc. London, p. 649, fig. **Siphonophora.**
Artocarpus integrifolia, Onesma ferrea.

arundicolens, Callipterus Clarke, 1903. Can. Ent. XXXV, p. 249.
Arundo sp.

arundinis, Hyalopterus (Fabricius), 1775. Systema Entomologiae, p. 734. **Aphis.**
Amophila arundinacea, Amygdalus communis, Arundo sp., Calamagrostis epigeios, C. littorea, Dactylis glomerata, Elymus avenarius, Phragmites communis, P. vulgaris, Prunus armeniaca, P. domestica, P. insititia, P. persicae, P. spinosa, Salsola kali, Scirpus caespitosus, S. lacustris, Vistis vinifera.

arundinis, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 3, p. 144.
Arundo phragmitis, Calamogrostia epigeios.

ascita, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1045.
Cucumis melo.

asclediadifolii, Macrosiphum (Thomas), 1879. Eighth Rept. State Ent., Illinois, p. 58. **Siphonophora.**
Should read M. asclepiadifolii.
Asclepias cornuti.

asclepiadis, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 65.
Acerates floridana, Apocynum cannabium, Asclepias speciosa, A. stenopylla, A. syriaca, Citrus aurantium, Euphorbia sp., Nerium oleander.

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asclepiadis, Macrosiphum (Cowen), 1895. Hemiptera of Colo., p. 123. **Nectarophora.**
Asclepias speciosa, A. tridentata.

asclepiadis, Myzocallis Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 29. **Callipterus.**
Asclepias amplexicaulis, A. obtusifolia, A. syriaca.

asclepiadis, Myzus Passerini, 1863. Aphididae Italicae, p. 25.
Asclepias curassavica, A. grandiflora, A. "lunata," A. syriaca, A. tuberosa, Citrus aurantium, Comphocarpus fructicosus, Nerium oleander, Salix sp.

asperulae, Aphis Walker, 1848. The Zool., VI, p. 2248.
Asperula odorata.

assidua, Aphis Walker, 1849. The Zool. VII, p. 40, app.
Pyrus germanica.

assueta, Aphis Walker, 1849. The Zool., VII, p. 49, app.
Daucus carota.

asteris, Aphis Walker, 1849. Ann. Mag. Nat. Hist., ser. 2, III, p. 48.
Aster trifolium.

asteris, Pemphigus Lichtenstein, 1884. La Flore des Aphidens, p. 13. No description.
Aster sp.

atomaria, Aphis Walker, 1849. The Zool., VII, p. 50, app.
Atriplex patula.

atra, Macrosiphum (Ferrari), 1872, Ann. Mus. Civ. Stor. Nat. Genova, II, p. 58. **Siphonophora.**
Artemisia abrotanum, A. camphorata, A. variabilis, A. vulgaris.

atratus, Chermes Buckton, 1883. Mon. Brit. Aphides, IV, p. 39, fig.
Quercus sp.

atriplicis, Aphis Linnaeus, 1761. Fauna Suecia ed. altera p. 262.
Atriplex hastata, A. hortensis, A. latifolia, A. littoralis, A. patula, A. portulacoides, Beta vulgaris, Chenopodium album, C. hybridum, C. murale, C. polyspermum, C. urbicum, C. vulvaria, Rumex altissimus, R. crispus.

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atronitens, Aphis Cockerell, 1903. Trans. Amer. Ent. Soc. XXIX, p. 115.
Vicia sp.

atropae, Macrosiphum (Mordwilko), 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 271. **Siphonophora.**
Atropa belladona.

attenuatus, Pemphigus Osborne and Sirrine, 1892. Proc. Iowa Acad. Sci., I, p. 100. Reprinted, 1893, Insect Life, V, p. 237.
Smilax rotundifolia.

aubletia, Aphis Sanborn, 1904. Kansas Aphididae, p. 48.
Verbena aubletia.

aucta, Aphis Walker, 1849. The Zool. VII, p. 33, app.
Arenaria peploides.

aucupariae, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 76, fig.
Pyrus aucuparia, P. malus, P. torminalis.

aurantiaca, Macrosiphoniella Del Guercio, 1913. Redia, IX, p. 117. No description.

aurantiae, Toxoptera Koch, 1857. Die Pflanzenläuse Aphiden, p. 254, fig.
Citrus aurantium.

aurantii, Toxoptera (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 178. **Aphis.**
Camellia oleiferae, C. thea, Citrus aurantium, C. medica, Coffea sp., Pellionia sp., Straussia sp., Thea (Camellia) japonica.

australis, Lachnus Ashmead, 1881. Can. Ent. XIII, p. 68.
Pinus palustris, P. serotina.

avellanae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 168, fig. **Aphis.**
Corylus avellana.

avellanae, Myzocallis (Schrank), 1801. Fauna Boica, II, p. 112. **Aphis.**
Corylus avellana.

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avenae, Aphis Fabricius, 1775. Systema Entomologiae, p. 736.
Agrostis alba, Apium graveolens, Arrhenatherum elatius, Avena fatua, A. orientalis, A. sativa, A. strigosa, Bromus hordeaceous, B. inermis, B. racemosus, B. secalinus, B. unioloides, Capsella bursa-pastoris, Coreopsis sp., Crataegus coccinea, C. oxyacantha, Cydonia vulgaris, Dactylis glomerata, Elymus canadensis, E. geniculatus, E. virginicus, Euchlaena mexicana, Festuca ovina, F. ovinaduriuscula, F. rubra, Glyceria fluitans, Holcus lanatus, Hordeum distichon, H. hexastichon, H. jubatum, H. murinum, H. vulgare, Koeleria cristata, Lolium multiflorum, L. perenne, Melica bauhini, M. penicillaris, Opulaster opulifolius, Phalaris arundinacea, Phleum pratense, Poa annua, P. compressa, P. pratensis, P. trivialis, Polygonum persicaria, Prunus padus, P. virginiana, Pyrus communis, P. germanica, P. malus, Secale cereale, Setaria glauca, S. italica, Sorghum halepense, S. saccharatum, S. vulgare, Syntherisana sanguinale, Triticum dicoccum, T. vulgare.

avenae, Sipha Del Guercio, 1900. Nuov. Relaz. Staz. Ent. Agr. Fir., II, p. 116.
Avena sativa, Cynodon dactylon, Hordeum murinum.

avenivorum, Macrosiphum Kirkaldy, 1905. The Entomologist, XXXVIII, p. 132.
New name for **Macrosiphum granaria** (Kirby) Buckton.

baccharidis, Macrosiphum (Clarke), 1903. Can. Ent. XXXV, p. 254. **Nectarophora.**
Baccharis sp.

bakeri, Aphis Cowen, 1895. Hemiptera of Colo., p. 118.
Amsinckea sp., Anthemis sp., Artemesia sp., Crataegus sp., Gnaphalium sp., Medicago sativa, Melilotus alba, Pyrus communus, P. malus, Senecio vulgaris, Trifolium pratense, T. repens.

balbianii, Phylloxera Lichtenstein, 1874. Compt. Rend. Acad. Sci., LXXIX, part 2, p. 781.
Food plant?

ballii, Brachycolus Gillette, 1908. Can. Ent., XL, p. 67, fig.
Carex nebraskensis.

ballotae, Aphis Passerini, 1860. Gli Afidi, p. 35.
Ballota nigra, Marrubium sp.

balsamiferae, Pemphigus Williams, 1911. Aphididae Nebraska, p. 8.
Populus balsamifera.

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***balsamitae, Aphis** Müller, 1776. Zool. Dan. Prodr., p. 109.
Achillea ligustica, A. millefolium, A. odorata, A. ptarmica, Anthemis tinctoria, Bidens frondosa, Chrysanthemum balsamitae, Gnaphalium uglinosum, Helichrysum arenarium, H. chrysanthemum, H. stoechas, Lamium purpureum, Matricaria sp., Papaver sp., Senecio vulgaris.

bambusae, Aphis Fullaway, 1910. Rept. Hawaii Agr. Exp. Sta., (1909), p. 35, fig.
Bambusa sp., Phyllostachys sp.

bambusae, Oregma Buckton, 1893. Ind. Museum Notes, III, p. 87.
Bambusa arundinacea, Drendrocalamus giganteus.

bartsiae, Aphis Walker, 1849. The Zool. VII, p. 49, app.
Bartsia viscosa.

basalis, Aphis Walker, 1848. The Zool. VI, p. 2220.
Lycopsis arvensis.

beccabungae, Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 146, fig.
Chrysanthemum coronarium, C. leucanthemum, Veronica anagallodes, V. beccabunga.

bedfordi, Macrosiphoniella? Theobald, 1914. Bul. Ent. Research, IV, p. 318, fig.
Chrysanthemum sp.

begoniae, Macrosiphum Schouteden, 1901. Ann. Soc. Ent. Belg., XLV, p. 117.
Begonia sp.

bella, Endeis Koch, 1857. Die Pflanzenläuse Aphiden, p. 312, fig.
Avena sativa, Bromus sterilis, Hordeum vulgare, Panicum miliaceum, Setaria glauca, S. viridis, S. verticillata, Triticum sp., Zea mays.

bellidis, Aphis Mosley, 1841. Gardners Chronicle, I, p. 684.
(Bellis perennis?).

bellis, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 98, fig.
Bellis perennis.

bellula, Aphis Walker, 1849. The Zool. VII, p. 36, app.
Prunus spinosa.

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belius, Callipterus (Walsh), 1862. Proc. Ent. Soc. Phila., I, p. 299. **Aphis.**
Myrica gale, Quercus agrifolia, Q. alba, Q. cerris, Q. coccinea, Q. macrocarpa, Q. robur, Q. rubra, Ulmus racemosa.

berberidis, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y., Cab. Nat. Hist., p. 65.
Berberis vulgaris?

berberidis, Liosomaphis (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 95. **Aphis.**
Berberis vulgaris.

berlesei, Sipha Del Guercio, 1904. Redia II, p. 135. fig.
Aira caryophyllea, Deschampsia flexuosa.

betae, Macrosiphum (Theobald), 1913. Jour. Board of Agr., XIX, No. 11, p. 918. **Rhopalosiphum.**
Beta sp., "Chenopodiaceae."

betae, Pemphigus Doane, 1900. Ent. News, XI, p. 391. also Wash. Exp. Sta., Bul. 42, p. 1.
Achillea millefolium, Agropyron occidentale, Beta vulgaris, Chenopodium album, Distichlis spicata, Hordeum jubatum, Iva xanthifolia, Polygonum aviculare, Populus deltoides, Rumex crispus, R. hymenosepalus, R. occidentalis, Solidago sy.

betae, Smynthurodes Westwood, 1849. Gardners Chronicle, p. 420.
Beta sp.

betulae, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 217, fig.
Betula alba, B. fontinalis.

betulae, Chaitophorus Buckton, 1879. Mon. Brit. Aphides, II, p. 139, fig.
Acer campestre, Betula alba.

betulae, Euceraphis (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Betula alba.

betulae, Hamamelistes (Mordwilko), 1901. Horae Soc. Ent. Ross., XXXIII, p. 973, fig. **Cerataphis.**
Betula alba, B. alpestris.

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betulae, Vacuna Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 177.
Alnus glutinosa, Betula alba.

betulaecolens, Callipterus Monell, 1879. Bul. U. S. Geol. & Geog. Terr. Surv. V, No. 1, p. 30.
Betula fontinalis.

betulaecolens, Euceraphis (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 66. **Aphis.**
Betula alba, B. fontinalis, Tilia americana; and on apple by accident.

betularia, Callipterus (Kaltenbach), 1843. Mon. Der Pflanzenläuse, p. 119. **Aphis.**
Betula alba, B. nigra.

betulella, Calaphis Walsh, 1862. Proc. Ent. Soc. Phil., I, p. 301.
Betula alba, B. nigra.

betulicola, Callipterus (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 44. **Aphis.**
Betula alba, Carpinus betulus, Corylus avellana.

betulina, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1039.
Betula sp.?

betulina, Hamamelistes Horvath, 1896. Wien. Ent. Zeit., XV, p. 6. **Tetraphis.**
Betula alba.

betulina, Vacuna Buckton, 1886. Trans. Ent. Soc., London, p. 326, fig.
Betula alba.

betulinus, Chaitophorus Van Der Goot, 1912. Mitteilungen aus dem Naturhistorischen Museum, XXIX, p. 276.
Betula alba, Populus tremula.

beulahensis, Pterocomma (Cockerell), 1904. Can. Ent., XXXVI. p. 263. **Cladobius.**
Populus tremuloides.

bicolor, Aphis Haldeman, 1844. Proc. Bost. Soc. Nat. Hist., I, p. 168.
Food plant not given.

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bicolor, Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 139, fig.
Galium verum.

bicolor, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 212, fig.
No Food plant with the original description.

bicolor, Pterocomma (Oestlund), 1887. Aphididae of Minnesota, p. 36. **Melanoxanthus.**
Populus balsamifera, Salix sp.

bienis Myzus Sanborn.

bifrons, Aphis Walker, 1848. Ann. Mag. Nat. Hist., ser. 2, I, p. 444.
Alnus glutinosa?

bifrontis, Macrosiphum (Passerini) 1879. Bul. Soc. Ent. Ital., XI, p. 45. **Siphonophora.**
Inula viscosa.

bignoniae, Sipha Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 362. **Lachnus.**
Catalpa bignonioides, Tecoma radicans.

bipunctatum, Phylloxera Lichtenstein, 1874. Bul. Soc. Ent. France, p. CCI.
Quercus sp.

bituberculata, Aphis Wilson, 1913. Ent. News, XXV, p. 298, fig.
Saccharum officinarum.

bituberculata, Pterocomma Theobald, 1912. Rept. Econ. Zool., Year ending Sept. 30, 1912, pp. 82–84, figs.
Food plants?

bobretzkyi, Stomaphis Mordwilko, 1901. Horae Soc. Ent. Ross., XXXIII, p. 412.
Populus nigra, Salix sp.

bogdanowi, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ. p. 115.
Picea abies.
For description in German see Zool. Anz. XVIII, 1895, p. 97.

borealis, Pemphigus Tullgren, 1909. Ark. Zool. V, No. 14, p. 142, fig.
Populus nigra, P. pyramidalis.

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bouveri, Chermes Cholodkovsky, as var. of C. piceae Ratzburg, which see

***boyeri, Pemphigus** Passerini, 1856. Giornale Giardini III, p. 262.
Coix lacryma-jobi, Digitaria humifusa, Oryza sativa, Poa praetensis.
For other food plants see *P. radicum* Boyer.

boyeri, Pemphigus Passerini, (var. **saccharata** Del Guercio, 1900. *Nuov. Rel. Staz. Fir., II, p. 93.*

braggii, Drepanosiphum Gillette, 1907. Can. Ent., XXXIX, p. 393, fig.
Acer negundo.

braggii, Myzus Gillette, 1908. Can. Ent. XL, p. 17, fig.
Circium arvense, Cynara sp., Elaeagnus argentea, Scolymnus sp., Shepherdia argentea.

brasiliensis, Ceratavacuna Hempel, 1901. Ann. Mag. Nat. Hist., ser. 7, VIII, p. 384.
Cattleya loddigesii, Epidendrum sp.

brassicae, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 452.
Brassica adpressa, B. alba, B. arvensis, B. campestris, B. fruticulosa, B. napus, B. nigra, B. oleracea, B. rapa, Bunias erucago, Capsella bursa-pastoris, Crambe maritima, Diplotaxis tenuifolia, Erysimun australe, E. canescens, Hesperis matronalis, Isatis tintoria, Lepidium sativum, Raphanus landra, R. raphanistrum, R. sativus, Spinacia oleracea, Thalictrum minus.

brassica-napus, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic Rev. III, p. 17.
Brassica napus.

brevicauda, Macrosiphonella Del Guercio, as var. of M. chrysanthemi Del Guercio, which see.

brevicornis, Pemphigus (Hart), 1894. Eighteenth Report Nox. & Ben. Ins. Ill., p. 97, fig. **Tychea.**
Achillea ageratum, A. millefolium, Aster sp. Chenopodium album, Euphorbia sp., Iva sp., Rumex occidentalis, Zea mays.

brevis, Aphis Sanderson, 1902. Thirteenth Rept. Del. Agr. Exp. Sta. p. 157, fig.
Crataegus coccinea, Cydonia vulgaris, Lathyrus odoratus, Pyrus japonica, P. malus.

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breviorostris, Pterochlorus Mordwilko, as var. of **P. roboris** Linn., which see.

brevisiphona, Aphis Theobald, 1913. Jour. Board Agr., XIX, No. 11, p. 920, fig.
Beta vulgaris, Chenopodium sp.

brittenii, Rhopalosiphum Theobald, 1913. Jour. Econ. Biol., VII, p. 107, fig.
Ribes sp.

brunnea, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 70.
Ononis calumae, O. natrix, O. spinosa.

brunellae, Aphis Scouteden, 1903. Ann. Soc. Ent. Belg., XLVII, p. 194.
Prunella vulgaris?

bruneri, Chaitophorus Williams, 1911. Aphididae Nebraska, p. 25.
Populus tremuloides.

bufo, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 46.
Carex arenaria, Lycopsis arvensis.

bumeliae, Prociphilus (Schrank) 1801. Fauna Boica, II, p. 102.
Abies balsamea, A. fraseri, A. veichii, Fraxinus excelsior Pinus sp.

burrowi, Pemphigus Sanborn, 1904. Kansas Aphididae, p. 18.
Radicula sinuata.

bursarus, Pemphigus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Cheiranthus cheiri, Chenopodium sp., Cichorium intybus, Lactuca saligna, L. scariola, L. virosa, Lysimachia sp., Melilotus officinalis, Populus. deltoides, P. molinifera, P. nigra, P. pyramidalis, P. tremula, Sonchus asperis, S. oleraceus.

butomi, Rhopalosiphum (Schrank), 1801. Fauna Boica, II, p. 114. **Aphis.**
Butomus umbellatus?

buxtoni, Rectinasus Theobald, 1914. The Entomologist, XLVII, p. 29.
In nest of *Bothryomyrmex meridionalis Pheidole pallidula,* Termites. *Leucotermes lucifugus.*

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cadiva, Aphis Walker, 1849. The Zool. VII, p. 32, app.
Silene maritima.

***caerulescens, Pemphigus** Passerini, 1856. Giornale Giardini, III, p. 262.
Ulmus campestris.

caianense, Macrosiphum (Del Guercio), 1900. Nuov. Rel. Staz. Fir., II, ser. 1, p. 168. **Siphonophora.**
Sorghum saccharatum.

calaminthae, Phorodon Macchiati, 1885. Bul. Soc. Ent. Ital., XVII, p. 54.
Satureja vulgaris, Teucrium sp.

calaminthae, Rhopalosiphum Lichtenstein, 1884. La Flore des Aphidens, p. 15. No description.
Calamintha sp.

calendulae, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 21.
Bidens laevis, Calendula arvensis.

calendulella, Macrosiphum (Monell) 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 19. **Siphonophora.**
Bidens laevis, Calendula arvensis.

calendulicola, Aphis Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, p. 23.
Bidens laevis, Calendula arvensis, C. officinalis, Chrysanthemum sp.

californica, Macrosiphum (Clarke), 1903. Can. Ent., XXXV, p. 254. **Nectarophora.**
Salix sp.

californicus, Essigella (Essig), 1909. Pom. Jour. Ent., I, p. 1, fig. **Lachnus.**
Pinus sp.

californicus, Monellia Essig, 1912. Pom. Coll. Jour. Ent., 4, p. 767, fig.
Juglans californica.

californicus, Pemphigus Davidson, 1911. Jour. Econ. Ent. IV, p. 414.
New name for *Pemphigus ranunculi*, Davidson. Name preoccupied.

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callae, Macrosiphum? (Henrich), 1909. Verhand. Mitt. Sieb. Ver. Naturw. LIX, p. 26. **Siphonophora.**
Richardia africana.

callipterus, Aphis Hartig, 1841, Zeit. Entom. (Germar) III, p. 369.
Betula sp.

callunae, Aphis Theobald, 1915. The Entomologist, XLVIII, p. 260.
Calluna vulgaris.

calotropidis, Aphis Del Guercio, 1916. Redia, XI, p. 299, fig.
Calotropis, procera.

calthae, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 48, fig.
Caltha palustris.

camelliae, Toxoptera (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 122. **Aphis.**
Camellia japonica, Citrus medica.

camellicola, Aphis Del Guercio, 1913. Redia, IX, p. 161, fig.
Camellia sp.

campanulae, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 26. **Aphis.**
Aster linosyres, Campanula erinus, C. persicifolia, C. rotundifolia, C. tracchelium, Chrysanthemum leucanthemum, Specularia speculum.

campanula-riparia, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev. I, p. 361.
Campanula rotundifolia.

canadensis, Microsiphum (Williams), 1911. Aphididae of Nebraska, p. 89. **Cryptosiphum.**
Artemisia canadensis, A. ludoviciana.

canadensis, Pemphigus Del Guercio, 1913. Redia, IX, p. 151, fig.
Populus canadensis, P. nigra.

canae, Aphis Williams, 1911. Aphididae of Nebraska, p. 39.
Artemisia cana.

candicans, Aphis Passerini, 1879. Bul. Soc. Ent. Ital., XI, p. 46.
Orobanche ramosa.

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candicans, Chaitophorus? Thomas, 1877. Trans. Ill. State Hort. Soc. N. S. X, p. 169, **Aphis.** No description.

cannabis, Phorodon Passerini, 1860. Gli Afidi, p. 34.
Cannabis sativa.

capreae, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 6.
Salix caprea, S. fragilis.

capreae, Siphocoryne (Fabricius), 1775. Systema Entomologiae p. 734. **Aphis.**
Aegopodium podograria, Angelica archangelica, A. atropurea, A. sylvestris, Apium graveolens, A. nodiflorum, Carum sp., Chaerophyllum sylvestris, C. temulum, Conium maculatum, Coreopsis sp., Daucus sp., Foeniculum vulgare, Heracleum spondylium, Liotris sp., Pastinaca sativa, Petroselinum hortense, Peucedanum alsaticum, P. officinalis, Salix alba, S. amygdaloides, S. babylonica, S. caprea, S. lucida.

capsellae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 58.
Callistephus hortensis, Capsella bursa-pastoris, Chaerophyllum temulum, C. silvestris, Mentha longifolia, M. sylvestris, Parietaria officinalis, Verbena chamaedryfolia, V. officinalis.

capsellae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 76, fig.
Capsella bursa-pastoris.

caraganae, Macrosiphum Cholodkovsky, 1907. (1908), Revue Russe d' Entomologie, VII, pp. 87–95, fig.
Caragana arborescens, C. pygmaea.

carbocolor, Aphis Gillette, 1907. Can. Ent. XXXIX, p. 391, fig.
Rumex altissimus.

carduella, Aphis Walsh, 1862. Proc. Ent. Soc. Phil., I, p. 300.
Cirsium altissimum, C. lanceolatum.

carduellinum, Rhopalosiphum Theobald, 1915. Bul. Ent. Research, VI, p. 113, fig.
Carduus sp.

cardui, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 452.
Anthemis maritima, A. tinctoria, Arctium lappa, Borago officinalis, Carduus acanthoides, C. crispus, C. nutans, Chrysanthemum

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leucanthemum, Cirsium arvense, C. lanceolatum, C. muticum, Cynara cardunculus, Doronicum cruenta, Eryngium campestre, Hieracium umbellatum, Lithospermum officinale, Malva rotundifolia, M. sylvestris, Matricaria chamomilla, Onopordon acanthium, O. illyricum, Onosma stellulatum, Prunus nigra, Scolymnus hispaniscus, Senecio erucifolius, S. jacobaea, S. vulgaris, "Veridium."

carduina, Phorodon (Walker), 1850. Ann. Mag. Nat. Hist., ser. 2, VI, p. 44. **Aphis.**
Carduus nutans, Cirsium lanceolatum.

caricis, Aphis Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 218.
Carex pseudo-cyperus.

caricis, Carolinaia Wilson, 1911. Can. Ent., XLIII, p. 61.
Carex sp.

caricis, Toxoptera Fullaway, 1910. Rept. Hawaii Agr. Exp. Sta., (1909), p. 32, fig.
Carex sp.

carlucciana, Vacuna Del Guercio, 1913. Redia, IX, p. 289, fig.
Castanea sativa.

carnosa, Endeis Buckton, 1883. Mon. Brit. Aphides, IV, p. 92, fig. Taken in ants nest.
Avena pratensis.

carnosa, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 144. **Siphonophora.**
Urtica urens.

carnosa Macrosiphum (Buckton), var. **impatientis,** Williams, 1911. Aphididae Nebraska, p. 74. **Siphonophora.**
Impatiens biflora, I. pallida.

carotae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 112, fig.
Daucus carota, D. setulosus, Pastinaca sativa, Tordylium apulum.
Tordylium apulum.

carpini, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 216, fig.
Betula alba, B. tremula, Carpinus betulus, Corylus avellana.

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caryae, Eriosoma Fitch, 1856. Third Rept. Nox. Ben. Insects N. Y., p. 443.
Carya sp. Juglans nigra.

caryae, Longistigma (Harris), 1841. Insects Inj. Veg., p. 208. **Aphis.**
Acer saccharinum, Carya alba, C. cordiformis, C. glabra, Juglans nigra, Platanus occidentalis, Populus sp., Quercus marilandica, Tilia americana, T. cordata.

caryae, Monellia (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 31. **Cellipterus.**
Carya illinoensis, C. ovata, Juglans nigra, J. regia.

caryae-avellana, Phylloxera Riley, 1880. The American Entomologist, III, p. 230.
C. alba, Carya ovata.

caryaecaulis, Phylloxera (Fitch), 1855. First Rept. Nox. & Ben. Insects N. Y., p. 155. **Pemphigus.**
Carya alba, C. cordiformis, C. glabra, C. ovata.

caryae-fallax, Phylloxera Riley, 1875. Seventh Rept., Nox. & Ben. Insects Mo., p. 118.
Carya alba, C. ovata.

caryaefoliae, Callipterus Davis, 1910. Ent. News, XXI, p. 198, fig.
Carya sp.

caryaefoliae, Phylloxera Fitch, 1856. Third Rept. Nox. & Ben. Insects N. Y., p. 446.
Carya alba, C. glabra.

caryae-globuli, Phylloxera Walsh, 1862. Proc. Ent. Soc. Phil., I, p. 309.
Carya alba, C. glabra, C. ovata.

caryae-gummosa, Phylloxera Riley, 1875. Seventh Rept., Nox. & Ben. Insects, Mo., p. 118.
Carya alba.

caryae-magnum, Phylloxera (Shimer), 1869. Trans. Am. Ent. Soc., II, p. 391. **Dactylosphaera.**
Carya alba, C. cordiformis.

caryae-pilula, Xerophylla Walsh, 1867. Proc. Ent. Soc. Phil., VI, p. 283. No description.
Carya glabra.

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caryae-ren, Phylloxera Riley, 1875. Seventh Rept. Nox. & Ben. Insects, Mo., p. 118.
Carya glabra.

caryae-scissa, Phylloxera Riley, 1880. The American Entomologist, III, p. 230.
Carya alba, C. ovata.

caryae-semen, Phylloxera Walsh, 1867. Proc. Ent. Soc. Phil., VI, p. 283.
Carya glabra.

caryae-septum, Phylloxera (Shimer), 1869. Trans. Am. Ent. Soc., II, p. 389. **Dactylosphaera.**
Carya alba, C. glabra.

caryae-septum Phylloxera var. **perforans,** Pergande, 1904. Proc. Dav. Acad. Sci. IX, p. 193.
Carya glabra.

caryaevenae, Phylloxera (Fitch), 1856. Third Rept. Nox. & Ben. Insects N. Y., p. 444. **Pemphigus**
Carya alba.

caryella, Monellia (Fitch), 1855. First Rept. Nox. & Ben. Insects N. Y., p. 163. **Aphis.**
Carya alba, C. cordiformis, C. ovata, Juglans californica.

castanae, Vacuna Del Guercio, 1913. Redia, IX, p. 289, fig.
Castanea sp.

castanea, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 131, fig.
Cirsium arvense, C. lanceolatum.

castaneae, Callipterus Fitch, 1856. Third Report Nox. & Ben. Insects N. Y., p. 471.
Castanea dentata, C. sativa.

castaneae, Callipterus Buckton, 1881. Mon. Brit. Aphides, III, p. 26, fig.
Castanea vesca.

castaneae, Phylloxera (Haldeman), 1850. Amer. Jour. Sci. Arts, IX, ser. 2, p. 108. **Chermes.**
Castanea dentata, C. sativa.

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castanea-vesca, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist. I, p. 168.
Castanea pumila, C. vesca.

cathartica, Aphis Del Guercio, 1909. Rivista di Pat. Veg., IV, p. 5.
Rhamnus frangula.

caudata, Macrosiphum (Pergande), 1900. Proc. Wash. Acad. Sci., II, p. 513. **Nectarophora.**
Food plant unknown.

caudata, Trama Del Guercio, 1909. Redia, V, p. 246, fig.
Lactuca scariola.

ceanothi, Aphis Clarke, 1903. Can. Ent. XXXV, p. 250.
Ceanothus cuneatus, C. integerrimus.

ceanothi-hirsuti, Aphis Essig, 1911. Pom. Jour. Ent. 3, p. 525, fig.
Ceanothus hirsutus.

cecconii Lachniella Del Guercio, as var. of **L. cilicica** Del Guercio, which see.

cembrae, Chermes Cholodkovsky, 1888. Zool. Anz., XI, p. 47.
Pinus cembra.

cembrae, Lachnus Cholodkovsky, as var. of **L. pini** Linn. which see.

centaureae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 63, fig.
Centaurea melitensis, C. scabiosa, C. sphaerocephala, Crepis biennis.

centranthi, Macrosiphum Theobald, 1915. The Entomologist, XLVIII, p. 261.
Centranthus rubra, Valeriana officinalis.

cephalanthi, Aphis Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 11.
Cephalanthus occidentalis.

cephalicola, Aphis Cowen, 1895. Hemiptera of Colo., p. 118.
Trifolium repens.

cerasi, Aphis Müller, 1776. Zool. Dan. Prod. p. 110, fig.

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cerasi, Aphis Schrank, 1801. Fauna Boica, II, p. 115.
Prunus cerasus, P. domestica, P. persica, P. spinosa.

cerasi, Myzus (Fabricius), 1775. Systema Entomologiae, p. 734. **Aphis.**
Ophrys aranifera. Photinea serratula, Prunus avium, P. cerasus, P. domestica, P. mahaleb, P. persica, P. serotina.

cerasicolens, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 65.
Prunus avium, P. serotina.

cerasifoliae, Aphis Fitch, 1855. First Rept. Nox. & Ben. Insects N. Y., p. 131.
Prunus avium, P. nigra, P. pennsylvanicum, P. serotina, P. virginiana.

cerasina, Aphis Walker, 1850. Ann. Mag. Nat. Hist., ser. 2, VI, p. 43.
Prunus avium.

cerastii, Macrosiphum (Kaltenbach), 1846. Ent. Zeit. (Stettive), VII, p. 171. **Aphis.**
Cerastium arvense, Stellaria graminea, S. holostea.

ceratoniae, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 18. No description.
Ceratonia sp.

cerealis, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 16. **Aphis.**
Agropyron repens, Agrostis alba, Apera spicaventi, Avena fatua, A. sativa, A. strigosa, Bromus hordeaceous, B. secalinus, B. sterilis, Dactylis glomerata, Echinochla crus-galli, Elymus canadensis, E. virginicus, Glyceria fluitans, Holcus lanatus, H. mollis, Hordeum distichon, H. murinum, H. vulgare, H. vulgare-himalayense, Lolium perenne, Poe annua, P. pratensis, Polygonum persicaria, Secale cereale, Setaria viridis, Trifolium pratense, Triticum sativum, T. spelta, T. villosum, T. vulgare.

cerealium, Schizoneura Szaniszló, 1880. Term Fuzetek, IV, pp. 192–196–233.
Hordeum sp., Triticum sp.

cerricola, Pterochlorus Del Guercio, 1909. Redia, V, p. 266, fig.
Quercus cerris.

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certa, Aphis Walker, 1849. The Zool. VII, p. 32, app.
Viola tricolor

chaerophilli, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 79, fig.
Beta vulgaris, Caucalis daucoides, Chaerophyllum aromaticum, C. temulum, C. tuberosum, Daucus carota, Heracleum spondylium.

chamaedrys, Phorodon Passerini, 1879. Bul. Soc. Ent. Ital., II, p. 48.
Teucrium chamaedrys.

chamomillae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 65, fig.
Anthemis nobilis, Matricaria chamomilla.

chelidonii, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 41. **Aphis.**
Brassica oleracea, Chelidonium majus, Rubus idaeus.

chenophyllum-canadense, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic., Rev. I, p. 361.
Chenophyllum canadensis.

chenopodiae, Brevicoryne (Das) Van der Goot, 1915. Beitr. Kenntn. der Holland. Blatt. Harrlem, p. 245.
No description.

chenopodii, Aphis Schrank, 1801. Fauna Boica, II, p. 109.
Atriplex patula, Chenopodium album, C. glaucum.

chenopodii, Aphis Cowen, 1895. Hemiptera of Colo., p. 119.
Chenopodium album.

chinensis, Schlectendalia (Bell), 1851. Pharmaceutical Journal, X, p. 128. **Aphis.**
Distylium racemosum, Rhue sp.

chloris, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 91, fig.
Fragaria vesca, Cratiola officinalis, Hypericum crispum, H. montanum, H. peroratum, Scabiosa columbaria, Scrophylaria galericulata, Stachys recta.

cholodkovskyi, Macrosiphum Mordwilko, 1909. (Trudi), Bureau of Entomology, Dept. of Agri. St. Petersburg, VIII, p. 10.
Spiraea ulmaria.

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chrysanthemi, Aphis Walker, 1849. The Zool. VII, p. 56, app.
Chrysanthemum leucanthemum.

chrysanthemi, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 73, fig.
Chrysanthemum leucanthemum, Matricaria chamomilla, M. inodora.

chrysanthemi, Macrosiphoniella Del Guercio, 1911. Redia, VII, p. 332.
Chrysanthemum sp.

chrysanthemi, Macrosiphoniella Del Guercio as **var. brevicauda,** Del Guercio, 1913. Redia, IX, p. 117.
No description.

chrysanthemi, Macrosiphum (Oestlund), 1886. Aphididae of Minnesota, p. 22. **Siphonophora.**
Bidens connata, B. laevis.

chrysanthemicola, Aphis Williams, 1911. Aphididae of Nebraska, p. 39.
Chrysanthemum sp.

chrysanthemicolens, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 75. **Siphonophora.**
Chrysanthemum sp.

chrysothamni, Aphis Wilson, 1915. Trans. Amer. Ent. Soc., XLI, p. 101, fig.
Chrysothamnus lanceolatus.

cichorii, Aphis Dutrechet, 1833. Ann. Soc. Nat., XXX, p. 204.
Cichorium endiva, C. intybus.

cichorii, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 184, fig. **Siphonophora.**
Agrostemma githago, Cichorium endiva, C. intybus.

cicutae, Rhopalosiphum Koch, 1854. Die Pflanzenläues Aphiden, p. 24, fig.
Cicuta virosa.

cilicica, Lachniella Del Guercio, 1909. Redia, V, p. 297, fig.
Abies cilicica.

cilicica Lachniella var. cecconii Del Guercio, 1909. Redia, V, p. 297, fig.
Abies cilicica.

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cimiciformis, Paracletus Heyden, 1837. Ent. Beitr. Mus. Senk. II, p. 294.
Festuca ovina-duri-uscula.

cinchona, Pemphigus (Buckton) Atkinson, E. A., 1889. Ind. Museum Notes, I, p. 6.
Cinchona sp.

circeæandis, Aphis Fitch, 1870. Thirteenth Rept. Nox. & Ben. Insects, N. Y., p. 501.
Galium aparine, G. circaezans.

circumflexa, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 130, fig. **Siphonophora.**
Adriantum hybridum, Amorphophallus sp., Anemone cylindrica, Arabis sp., Artemisia dracunculoides, Arum italicum, Aster spp., Carduus flodmanii, Chrysanthemum sp., Cineraria sp., Cyclamen sp. Doronicum cruenta, Freesia sp., Hydrangea hortensia, Lilium candidum, Malvastrum coccineum, Oxalis rosea, "Persimmom" Physalis peruviana, Polymnia canadensis, Ranunculus acris, Richardia africana, Rudbeckia laciniata, Rumex obtusifolius, Sambucus canadensis, Schizanthus sp., Senecio cineraria, Solidago missouriensis, "Spiraxis", Steironema heterophyllum Tulipa sp. Vinca sp., Viola nuttallii.

circumvallata, Termitaphis Wasmann, 1903. Tijdschar. Ent., XLV, p. 105, fig.
Food plant not given. In an ants' nest.

cirsii, Macrosiphum (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Cirsium arvense.

cirsina, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 226.
Cirsium arvensis.

cistatus, Dryobius Buckton, 1881. Mon. Brit. Aphides, III, p. 78.
"Spruce fir".

cisti, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 20.
No description.
Cistus sp.

cisti, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1037.
No food plant given.

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citri, Aphis (Ashmead) Oestlund, 1887. Aphididae of Minnesota, p. 69. No description.
Citrus sp.

citricidus, Myzus Kirkaldy, 1907. Proc. Hawaii Ent. Soc., I, part 3, p. 100.
Citrus aurantium.

citricola, Aphis Van der Goot, 1912. Mitteilungen aus dem Naturehistorischen Museum, XXIX, p. 273.
Citrus sp.

citrifolii, Macrosiphum (Ashmead), 1880. Orange Insects, p. 66.
Citrus sp.

citrinum Macrosiphum Ashmead as a var. of **M. artemisiae** Boyer which see.

***citrulli, Aphis** Ashmead, 1882. Florida Dispatch, I, p. 241.
Citrus sp.

clematidis, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 78, fig.
Clematis flammula, C. recta, C. vitalba.

clematidis, Toxoptera Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir., II, p. 145.
Clematis vitalba.

clinopodii, Aphis Passerini, 1861. Att. Soc. Sci. Nat., III, p. 399.
Calamintha acinos, Mentha sylvestris, Satureja vulgaris.

cnici, Aphis Schrank, 1801. Fauna Boica, II, p. 122.
Cnicus oleraceus.

cnici, Aphis Williams, 1911. Aphididae of Nebraska, p. 40.
Cnicus sp.

coccinea, Phylloxera Heyden, 1837. Ent. Beitr. Museum Senkenberg, II, p. 289. **Vacuna.**
Quercus ilex, Q. robur.

coccineus, Chermes Ratzeburg, 1843. Stett. Ent. Zeit. IV, p. 202.
Abies balsamea, A. pectinata, Picea abies Pinus sp.

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coccus, Pemphigus Buckton, 1889. Trans. Linn. Soc., London, (2), V, p. 142, fig.
Pistacia vera.

coffeae, Aphis Nietner, 1880. The Coffee Tree and Its Enemies, p. 12.
Coffea arabica.

collega, Aphis Walker, 1848. The Zool. VI, p. 2218.
Artemisia maritima.

coloradensis, Chermes, Gillette, 1907. Proc. Acad. Nat. Sci. Phil., p. 16, fig.
Pinus contorta, P. edulis, P. ponderosa, P. scopulorum.

coluteae, Pemphigus Passerini, 1863. Aphididae Italicae, p. 75.
Colutea arborescens.

comes, Aphis Walker, 1848. Ann. Mag. Nat. Hist., ser. 2, I, p. 258.
Betula alba.

commoda, Aphis Walker, 1848. The Zool. VI, p. 2219.
Artemisia maritima.

compositae, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 123, fig.
"*Compositae*," species unknown.

compositae, Macrosiphum Theobald, 1915. Bul. Ent. Research VI, p. 106, fig.
Compositae sp., african plant called "*Mocatha.*"

compressa, Colopha Koch, 1857. Die Pflanzenläuse Aphiden, p. 267, fig. **Schizoneura.**
Ulmus americanus, U. campestris, U. "effusa."

confinis, Lachnus Koch, 1857. Die Pflanzenläuse Aphiden, p. 245, fig.
Juniperus communis.

confusa, Aphis Walker, 1849. The Zool. VII, p. 46, app.
Scabiosa arvensis.

conica, Phylloxera (Shimer), 1869. Trans. Am. Ent. Soc., II, p. 390. **Dactylosphaera.**
Carya alba, C. cordiformis.

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conifera, Phylloxera (Shimer), 1869. Trans. Am. Ent. Soc., II, p. 397. **Dactylosphaera.**
Carya cordiformis.

coniferarum, Chermes Cholodkovsky, 1883. Zool. Ans. XII, p. 222.
Picea abies, Larix dicidua.

conii, Siphocoryne Davidson, 1909. Jour. Econ. Ent., II, p. 304.
Conium maculatum.

conjuncta, Aphis Walker, 1848. The Zool. VI, p. 2220.
Lycopsis arvensis.

consolidae, Aphis Passerini, 1863. Aphididae Italicae, p. 43.
Matricaria chamomille, Symphitum officinale.

consolidatus, Chermes Patch, 1909. Psyche, XVI, p. 137.
Larix laricina, Picea mariana, P. rubra.

consona, Aphis Walker, 1849. The Zool., VII, p. 36, app.
Prunus spinosa.

consors, Aphis Walker, 1848. The Zool., VI, p. 2218.
Cynoglossum officinalis.

conspersa, Aphis Walker, 1849. The Zool., VII, p. 46, app.
Scabiosa arvensis.

consueta, Aphis Walker, 1848. The Zool., VI, p. 2219.
Lycopsis arvensis.

consumpta, Aphis Walker, 1849. The Zool. VII, p. 54, app.
Digitalis purpurea.

contermina, Aphis Walker, 1849. The Zool. VII, p. 31, app.
Cakile maritima.

convecta, Aphis Walker, 1849. The Zool., VII, p. 37, app.
Prunus domestica.

conviva, Aphis Walker, 1849. The Zool., VII, p. 36, app.
Prunus spinosa.

convolvuli, Macrosiphum (Kaltenbach), 1843. Mon der Pflanzenläuse, p. 40. **Aphis.**
Convolvulus arvensis C. sepium, C. tricolor, Ipomoea purpurea, Nemophila sp., Vinca major, V. minor.

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convolvulicola, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 66.
Convolvulus altheoides, C. arvensis.

cookii, Aphis Essig, 1911. Pom. Coll. Jour. Ent. 3, p. 587, fig.
Citrus sp.

cooleyi, Chermes Gillette, 1907. Proc. Acad. Nat. Sci. Phil., p. 3, fig.
Picea englemanni, P. pungens, Pseudotsuga douglassi.

cooleyi Chermes Gillette, var. coweni, Gillette, 1907. Proc. Acad. Nat. Sci. Phil., p. 10, fig.
Picea englemanni, Pseudotsuga douglassi.

coracinus, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 2, fig.
Acer campestre, A. platinoides, A. pseudo-platanus.

corallorhizae, Macrosiphum (Cockerell), 1903. Can. Ent., XXXV, p. 167. **Nectarophora.**
Corallorhiza multiflora.

cordatae, Chaitophorus Williams, 1911. Aphididae of Nebraska, p. 26.
Salix cordata.

coreopsidis, Macrosiphum (Thomas), 1877. Ill. State Lab. Nat. Hist. Bul. 2, p. 7. **Siphonophora.**
Bidens aristosa, B. bipinnata, B. frondosa, B. vulgata.

coriandri, Brevicoryne (Das) Van Der Goot, 1915. Beitr Kenntn. Holländ. Blat. Harrlem, p. 245.
No description.

corni, Anoecia (Fabricius), 1775. Systema Entomologiae, p. 736. **Aphis.**
Andropogon furcatus, Bromus hordeaceous, B. sterilis, B. unioloides, Capsella bursa-pastoris, Cornus amomum, C. asperifolia, C. paniculata, C. sanguinea, C. stolanifera, Digitaria humifusus, D. sanguinalis, Echinochloa crus-galli, Eragrostis major, E. megastachya, E. pectinacea, Festuca ovina-duriuscula, Grindelia squarrosa, Holcus lanatus, Hordeum jubatum, Muhlenbergia racemosa, Panicum capillare, P. dichotomiflorum, P. proliferum, Phleum pratense, Polygonum aviculare, P. pennsylvanica, P. persicaria, Prunus domestica, Setaria glauca, S. italica, S. viridis, Sorghum vulgare, Spartina cynosuroides, Triticum vulgare, Zea Mays.

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corni, Schizoneura Hartig, 1841. Zeit. Ent. (Germar), III, p. 367.
Cornus sanguinea.

cornicola, Anoecia (Walsh), 1862. Proc. Ent. Soc. Phil., I, p. 304. **Eriosoma.**
Cornus stolanifera, Digitaria humifusa.

***cornicularius, Pemphigus** Passerini, 1856. Giornale Giardini, III, p. 261.
Pistacia terebinthus.

cornifila, Aphis Del Guercio, 1911. Redia, VII, p. 312, fig.
Cornus sp.

cornifoliae, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 65.
Amaranthus retroflexux, Cornus amomum, C. florida, C. paniculata, C. stolanifera, Iva xanthifoliae, Ribes aureum.

cornu, Hamamelistes Shimer, 1867. Trans. Amer. Ent. Soc. I, p. 283.
Hamamelis virginiana.

cornus-stricta, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Cornus stricta.

coronillae, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 69.
Coronilla pusilla.

corrugatans, Pemphigus Sirrine, 1894. Proc. Iowa Acad. Sci., I, p. 129.
Amelanchier alnifolia, A. ulmifolia, A. canadensis, Crataegus crus-galli, C. macrocapetra, C. occidentalis, C. oxyacantha, C. tomentosa.

corticalis, Chermes Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 197.
Pinus strobus, P. sylvestris.

corticalis, Phylloxera Kaltenbach, 1867. Vern. Nat. Ver. Preuss. Rheinl. Westph., p. 44.
Quercus robur.

corydalis, Macrosiphum (Oestlund) 1886. Aphididae of Minnesota, p. 25. **Siphonophora.**
Corydalis aurea.

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coryli, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 215, fig.
Corylus americana.

coryli, Macrosiphum Davis, 1914. Can. Ent. XLVI, p. 48, fig.
Corylus americana.

coryli, Myzocallis (Goeze), 1778. Ent. Beitrage, II, p. 311. **Aphis.**
Alnus glutinosa, Betula sp., Carpinus betulus, Corylus avellana, Fraxinus excelsior, Myrica gale.

corylinum, Rhopalosiphum Davidson, 1914. Jour. Econ. Ent., VII, p. 134, fig.
Corylus rostrata.

costata, Lachnus (Zetterstedt) 1828. Zett. Faun. Ins. Lapp., I, p. 559. **Aphis.**
Abies sp., Picea mariana.

costata, Schizoneura Hartig, 1841. Zeit. Ent. (Germar), III, p. 367.
Abies sp., Pinus sp.

coweni, Chermes Gillette, as var. of C. cooleyi Gillette which see.

coweni, Macrosiphum (Hunter), 1901. Iowa Agr. Exp. Sta. Bul., 60, p. 114. **Nectarophora.**
A new name for **M. artemisiae** Cowen.
Artemisiae tridentata.

coweni, Phyllaphis (Cockerell), 1905. Can. Ent. XXXVII, p. 392. **Pemphigus.**
Arctostaphylos uva-ursi.

craccae, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 452.
Vicia cracca, V. lutea, V. sativa, V. villosa. No description was given until 1761, Fauna Suecica editia altera, p. 260.

craccivora, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 124, fig.
Anagyris sp., Vicia cracca.

crassa, Tychae Cockerell, 1903. Psyche, X, p. 218.
Food plant not given.

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***crassirostris, Phylloxera** Dahl, 1912. Beitr. Naturdenkmalpfl, III, p. 435.
Food plant?

crataegaria, Macrosiphum (Walker) 1850. Ann. Mag. Nat. Hist. (2), VI, p. 46. **Aphis.**
Crataegus oxyacantha.

crataegella, Aphis Theobald, 1912. List of Aphididae of the Hastings District, p. 9.
A new name for **Aphis crataegi** Buckton not Kaltenbach.

crataegi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 66.
Crataegus oxyacantha, Pprus communis, P. malus, Ranunculus sp.

crataegi, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 64, fig.
Crataegus oxyacantha.

crataegi, Eriosoma (Oestlund) 1887. Aphididae of Minnesota, p. 27. **Schizoneura.**
Crataegus punctata, C. tomentosa.

crataegi, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, p. 20. **Siphonophora.**
Crataegus coccinea, C. oxyacantha, C. punctata.

crataegi, Prociphilus Tullgren, 1909. Ark. Zool. V. No. 14, p. 96, fig.
Crataegus oxyacantha, Pyrus malus.

crataegifoliae, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 66.
Crataegus coccinea, C. punctata.

crataegus-coccinea, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Crataegus coccinea.

creelii, Macrosiphum Davis, 1914. Canadian Entomologist, XLVI, p. 41, fig.
Medicago sp.

crithmi, Aphis Buckton, 1886. Trans. Ent. Soc. London, p. 323, fig.
Crithmum maritimum.

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croaticus, Pterochloris Koch, 1855. Die Pflanzenläuse Aphiden, p. 228, fig. **Dryobius.**
Quercus ilex, Q. robur.

crucis, Thomasia Essig, 1912. Pom. Coll. Jour. Ent., 4, p. 741, fig.
Salix longifolia.

cucubali, Aphis Passerini, 1863. Aphididae Italicae, p. 47.
Silene cucubalus, S. latifolia.

cucumeris, Aphis Forbes, 1882. Twelfth Rept. Nox. & Ben. Insects Ill., p. 83, fig.
Beta vulgaris, Cucumus melo, Cucurbita maxima.

cucurbitae, Macrosiphum (Thomas), 1879. Eighth Rept. State Ent., Ill., p. 67. **Siphonophora.**
Cucurbita maxima, C. pepo.

cucurbitae, Macrosiphum Mordwilko as a sub sp. of **M. cyparissiae** Koch which see.

cucurbiti, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 56, fig.
Cucumis sativus, Cucurbita maxima, C. pepo.

cuneomaculata Lachniella Del Guercio as a var. of **L. laricis(?)** which see.

cupressi, Lachnus Buckton, 1881. Mon. Brit. Aphides, III, p. 46, fig.
Cypress sp.

curtipilosa, Lachnus Mordwilko as a var. of **L. pineus** Mordwilko.

curvipes, Lachnus Patch, 1912. Me. Agr. Exp. Sta. Bul. 202, p. 161, fig.
Abies balsamea.

cydoniae, Aphis Boisduval, 1867, Essai Entom. Hort., p. 254.
Cydonia vulgaris.

cymbalariae, Aphis Schouteden, 1900. Ann. Ent. Soc. Belg. XLIV, p. 123.
Linaria cymbalaria.

cynarae Aphis Theobald, 1915. Bul. Ent. Research VI, p. 124, fig.
Cynara sp.

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cynoglossi, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 22. No description.
Cynoglossum sp.

cynoglossi, Phorodon Williams, 1911. Aphididae of Nebraska, p. 88.
Catalpa sp., Cynoglossum sp., Dianthus caryophyllus.

cynoglossum, Aphis Walker, 1848. The Zool., VI, p. 2217.
Cynoglossum officinale.

cynosbati, Macrosiphum (Oestlund), 1887. Aphididae of Minnesota, p. 81. Nectarophora.
Ribes aureum, R. cynosbati.

cyparissiae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 174, fig. Siphonophora.
Euphorbia cyparissia, E. peplus, Rebus fruticosus, Scabiosa succisa.

cyparissiae, Macrosiphum Koch, var. **cucurbitae**, Del Guercio, 1913. Redia, IX, p. 194.
Angelica arcangelica, A. sylvestris, Bryonia dioica, Calendula officinalis, Chrysanthemum frutescens, C. leucanthemum, Conium maculatum, Ecballion elaterium?
It is not clear to authors whether or not all of the above food plants were meant for this species.

cyparissiae, Acyrthosiphon Koch sub. sp. **cyparissiae**, Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 188. See **Macrosiphum cyparissiae** Koch.
Euphorbia sp.

cyparissiae, Acyrthosiphon Koch, sub sp. **propinquum**, Mordwilko, 1914. Fauna of Russia, (Insect Hemiptera), I, Petrograd., p. 193. See **Macrosiphum cyparissiae** Koch.
Euphorbia gerardiana.

cyperi, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 45.
Juncus lampocarpus.

cyperi, Carolinaia Ainslie, 1915. The Can. Ent., XLV, p. 85.
Cyperus esculentus.

cyperi, Geoica Schouteden, 1902. Zool. Anz., XXV, p. 656.
Cyperus virens.

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cyperis, Myzocallis Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 259.
Cynoglossum sp., Cyperis rotundus.

cytisorum, Aphis Hartig, 1841. Zeit. Ent. (Germar) III, p. 370.
Cytisus laburnum.

dactylidis, Hyalopterus Hayhurst, 1909. Jour. N. Y. Ent. Soc. XVII, p. 115.
Dactylis glomerata, Tridens flavus.

dahliae, Aphis Mosley, 1841. Ganders Chronicle, p. 628.
Dahlia sp.

danesii, Börneria Grassi and Foa, 1908. Atti Reale Accad. Lincei Rend. XVII, p. 683.
Quercus sp.

dauci, Aphis Fabricius, 1775. Systema Entomologiae, p. 737.
Achillea millefolium, A. ptarmica, Bellis perennis, Chrysanthemum leucanthemum, Daucus carota, Epilobium molle, Erigeron canadensis, Gossypium herbaceum, Lychnis dioica, Plantago major, P. media, P. coronopus, P. rugelii, Taraxacum officinale, Viola tricolor.

dauci, Forda Goureau, 1867. Bul. Soc. Ent. France, p. lxxxix.
Daucus sp., Lychnis dioica.

davisiana, Aphis Del Guercio, 1913, Redia, IX, p. 159.
This name given for **Aphis sambuci** (Linnaeus) Davis.
Sambucus sp.

degeeri, Pemphigus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 186.
Pinus sp.

delicata, Chaitophorus Patch, 1913. Me. Agr. Exp. Sta., Bul. No. 213, p. 80, fig.
Populus tremuloides.

dentatus, Lachnus LeBaron, 1872. Second Rept. Nox. & Ben. Insects, Ill., p. 138.
Salix sp.

deplanata, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 205.
Carya alba.

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depressa, Phylloxera (Shimer), 1869. Trans. Amer. Ent. Soc., II, p. 390. **Dactylosphaera.**
Carya alba, C. ovata.

derbesi, Pemphigus Lichtenstein, 1880. Bul. Soc. Ent. Fr., (5), X, p. LXXXII.
A new name for **Pemphigus pallidus** (Haliday), Derbes.
Pistachia terebinthus.

derelicta, Aphis Walker, 1849. The Zool. VII, p. 50, app.
Calystegia soldanella.

desmodii, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 76. **Siphonophora.**
Desmodium canescens.

despecta, Aphis Walker, 1849. The Zool. VII, p. 53, app.
Epilobium sp.

destructor, Macrosiphum (Johnson), 1900. Can. Ent. XXXII, p. 56. **Nectarophora.**
Pisum sativum.

detracta, Aphis Walker, 1849. The Zool. VII, p. 38, app.
Prunus domestica.

devastatrix, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 248.
Carya illinoensis.

devecta, Aphis Walker, 1849. The Zool. VII, p. 38.
Pyrus malus.

diani, Pemphigus Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 234.

dianthi, Rhopalosiphum (Schrank), 1801. Fauna Boica, II, p. 114. **Aphis.**
Dianthus caryophyllus, Pentaptes phoenicea, Solanum dulcamara, S. tuberosum.

dianthi, Rhopalosiphum var. poae, Williams, 1911. Aphididae of Nebraska, p. 70.
Hyoscyamus niger, Poa compressa.

diervilla-lutea, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 360.
Diervilla lutea.

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dilineatus, Hyalopterus Buckton, 1879. Mon. Brit. Aphides, II, p. 113, fig.
Rosa centifolia.

diminuta, Aphis Walker, 1850. The Zool. VIII, p. 103.
Senecio vulgaris.

diospyri, Aphis Thomas, 1879. Eighth Rept. State. Ent. Ill. p. 95.
Diospyros virginiana.

diphaga, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1042.
Epilobium sp.

diplanterae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 151, fig. Siphonophora.
Justica furcata, Malva sylvestris.

diplepha, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Rosa sp.

dipsaci, Macrosiphum (Schrank), 1801. Fauna Boica, II, p. 104. Aphis.
Cynara cardunculus, Dipsacus pilosus, D. sylvestris.

dirhoda, Macrosiphum (Walker) 1849. Ann. Mag. Nat. Hist., III, p. 43. Aphis.
Avena sativa, Bromus hordeaceous, Dactylis glomerata, Glyceria fuitans, Holcus sp., Hordeum murinum, Poa sp., Polygonum persicaria, Rosa canina, R. centifolia, R. eglonteria, R. rugos, Secale cereale, Triticum sativum.

discolor, Aphis Burmeister, 1835. Hand. der Entomologie, II, p. 94. No food plant given.

discolor, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist., I, p. 169. No food plant given.

discolor, Myzocallis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 30. Callipterus.
Quercus bicolor, Q. macrocarpa.

dispar, Aphis Walker, 1848. The Zool. VI, p. 2251.
Food plant unknown to authors.

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dispar, Myzus Patch, 1914. Me. Agr. Exp. Sta. Bul. 225, p. 50.
Ribes spp.

dissita, Aphis Walker, 1849. The Zool. VII, p. 34, app.
Lathyrus odoratus.

distychii, Nipponaphis Pergande, 1906. Ent. News, XVII, p. 205.
Distychium racemosum.

diversa, Aphis Walker, 1848. The Zool., VI, p. 2251.
Prunus domestica.

dolichi, Aphis Montrouzier, 1861. Ann. Soc. Ent. France, ser. 4, I, p. 74.
Dolichos sp.

donacis, Aphis Passerini, 1862. Atti. Soc. Ital. Sci. Nat. Milano III, p. 399.
Arundo donax.

donisthorpei, Trama Theobald, 1913. The Ent. Record, XXVII, p. 52.
In nest of *Tetramorium caespitum.*

dryophila, Vacuna (Schrank), 1801. Fauna Boica, II, p. 113. **Aphis.**
Cornus sanguinea, Quercus aegilops, Q. ilex, Q. robur.

dubia, Macrosiphum (Ferrari), 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 55. **Siphonophora.**
Artemisia campestris, A. vulgaris.

dubia, Rhopalosiphum (Curtiss), 1842. Jour. Royal Agr. Soc., III, p. 54, fig. **Aphis.**
Prunus persica.

dubium, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 180.
"Papilionacearum."

duffieldii, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 2, p. 88.
Tulipa sp.

edentula, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 39, fig.
Crataegus oxyacantha.

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edifactor, Pemphigus Buckton, 1893. Ind. Mus. Notes, III, p. 71.
Pistacia terebinthus.

egens, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1036.
No food plant given.

egressa, Aphis Walker, 1849. The Zool. VII, p. 38.
Prunus domestica.

elaeagni, Myzus Del Guercio, 1894. IL Naturalista Siciliana, XIII, p. 197.
Cirsium arvense, Elaeagnus angustifolia, E. reflexa, Shepherdia argentea.

elegans, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 213, fig.
Ulmus campestris.

elegans, Rhopalosiphum Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 217.
Salvia ceratophylloides, S. rectoflora.

elegans, Sipha Del Guercio, 1905. Redia, II, p. 137, fig.
Hordeum murinum.

eleusinis, Rhizobius Thomas, 1877, Ill. State Lab. Nat. Hist., Bul. 2, p. 15.
Eleusine indica.

emeljanovi, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 171.
Food plant?

epilobii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 64.
Epilobium angustifolium, E. hirsutum, E. molle, E. montanum, E. parviflorum, E. roseum, Gentiana cruciata.

epilobii, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V, p. 152.
Epilobium molle, E. palustre, Lavatera sp.

epilobii, Macrosiphum (Pergande), 1900. Proc. Wash. Acad. Sci. II, p. 515. Nectarophora.
Epilobium sp.

epilobiina, Aphis Walker, 1849. The Zool., VII, p. 53, app.
Epilobium sp.

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eragrostidis, Colopha Middleton, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 17.
Anthoxanthum odoratum, Eragrostis frankii, E. megastachya, E. minor, E. pilosa, Panicum sp.

eragrostidis, Tychea Passerini, 1860. Gli Afidi, p. 39.
Eragrostis megastachya, Poa annua, Setaria glauca, S. viridis, Triticum vulgare.

erecta, Aphis Del Guercio, 1911. Redia, VII, p. 314, fig.
Galium erectum.

ericae, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1038.
No food plant given.

erigeron-canadense, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 17.
Erigeron canadensis.

erigeronensis, Macrosiphum (Thomas), 1877, Ill. State Lab. Nat. Hist., Bul. 2, p. 7. **Siphonophora.**
Ambrosia trifida, Beta vulgaris, Erigeron canadensis, Lactuca pulchella, L. scariola.

erigeronensis, Tychea Thomas, 1879. Eighth Rept. State Ent. Ill., Vol. 5, p. 168.
Erigeron canadensis, Cichorium intybus, Echinochloa crus-galli, Poa pratensis, Zea mays.

erigeron-philadelphicum, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 361.
Erigeron philadelphicus.

erigeron-strigosum, Aphis Rafinesque 1818. Amer. Mon. Mag. & Crit. Rev., III, p. 17.
Erigeron ramosus.

eriobotryae, Aphis Schouteden, 1905. Broteria, IV, p. 164.
Eriobotyra japonica.

eriogoni, Aphis Cowen, 1895. Hemiptera of Colo., p. 119.
Eriogonum umbellatum, Eriogonum alatum, Erigeron acris.

eriophori, Hyalopterus (Walker), 1848. Anns. Mag. Nat. Hist. ser. 2, II, p. 46. **Aphis.**
Eriophorum vaginatum.

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erraticum, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 35, fig.
No food plant given.

erraticus, Prociphilus Koch, 1857. Die Pflanzenläuse Aphiden, p. 283, fig.
Food plant unkonwn to Koch.

erysimi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 99.
Capsella bursa-pastoris, Raphanus raphanistrum, Sisymbrium allaria, S. officinale.

eupatorii, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 39.
Eupatorium perfoliatum.

eupatorii, Aphis Passerini, 1863. Aphididae Italicae, p. 36.
Eupatorium cannabium, Malva sp., Stachys recta.

eupatorii, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 77. Siphonophora.
Eupatorium ageratoides, E. perfoliatum, E. urticaefolium.

euphorbiae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 94.
Erigeron canadensis, Euphorbia amygdaloides, E. biglandulosa, E. corrollata, E. cyparissia, E. esula, E. althyrus, E. peplus, E. terracina, E. virgata.

euphorbiae, Aphis Walker, 1849. The Zoologist, VII, p. 43, app.
Euphorbia peplus.

euphorbiae, Macrosiphum (Thomas), 1877, Ill. State Lab. Nat. Hist., Bul. 2, p. 6. Siphonophora.
Euphorbia maculata.

euphorbicola, Macrosiphum (Thomas), 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 6. Siphonophora.
Euphorbia hirsuta, E. marginata.

euphrasiae, Aphis Walker, 1849. The Zool. VII, p. 51, app.
Euphrasiae officinalis.

evonymi, Aphis Fabricius, 1775. Systema Entomologiae p. 736.
Evonymus europaeus, E. atropurpureus, Rhamnus frangula, Viburnum latana.

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exsiccator, Lachnus Altum, 1882. Forst Zoologie, III, p. 353, fig.
Fagus sylvatica.

exul, Aphis Walker, 1849. The Zool. VII, p. 31, app.
Pelargonium sp.

exul, Aphis Walker, 1849. The Zool. VII, p. 48, app.
Sambucus nigra.

***fabae, Aphis** Blanchard, 1840. Hist. Nat. Ins., III, p. 207.
Vicia faba.

fabae, Aphis Scopoli, 1763. Entomologia Carniolica, p. 139.
Vicia faba.

***fagi, Chermes** Altum, Forst Zoologie, III, p. 359, fig.
Fagus sp.

fagi, Chermes Linnaeus, 1761. Fauna Suecica, editio altera, p. 263.

***fagi, Phyllaphis** (Linnaeus), 1767. Systema Naturae, Edition, 12, p. 735. Aphis.
Fagus ferruginea, F. grandifolia, F. sylvatica.

fagifoliae, Pemphigus Del Guercio, 1913. Redia, IX, p. 175, fig.
Fagus sp.

familiaris, Aphis Walker, 1848. The Zool., VI, p. 2220.
Lycopsis arvensis.

farfarae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 54, fig.
Adenostyles albida, Tussilago farfara.

farinosa, Aphis Gmelin, 1788. Systema Naturae, I, part 4, p. 2210.
Salix sp.

farinosus, Pterocomma Del Guercio, 1913. Redia, IX, p. 178, fig.
Lamium sp.

***farinosus, Lachnus** Cholodkovsky, 1891. Rev. Sci. Nat. St. Petersburg, No. 8, pp. 294-305.
Picea abies, P. glauca, P. pungens, Pinus sp.

fasciata, Macrosiphoniella Del Guercio, 1913. Redia, IX, p. 117. For description see page 189, fig.
Artemisia campestris.

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fasciatus, Lachnus Burmeister, 1835. Hand. der Entomologie, II, p. 93.
Picea abies, P. mariana, Pinus strobus, P. sylvestris.

filaginea, Anuraphis Del Guercio, 1911. Redia, VII, p. 308, fig.
Filago gallica.

filaginis, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 25 No description.
Filago sp.

filaginis, Myzus Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 231.
Filago gallica.

filaginis, Pemphigus (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 183. Aphis.
Filago gallica, F. germanica, F. minima, Gnaphallium erectum, G. uliginosum, Populus alba, P. monilifera, P. nigra, P. pyramidalis.

filaginis, Macrosiphum (Lichtenstein), 1884. La Flore des Aphidens, p. 25. No description. Siphonophora.
Filago sp.

fitchii, Aphis Sanderson, 1902. 13th Rept. Del. Agr. Exp. Sta., p. 137, fig.
Crataegus coccinea, Pyrus germanica, P. malus.

fitchii, Chaitophorus Sanborn, 1904. Kansas Aphididae, p. 37.
Carex sp., Grass sweepings.

flaveola, Aphis Walker, 1849. The Zool. VII, p. 55, app.
Carduus sp.

flavescens, Trama Koch, 1857. Die Pflanzenläuse Aphiden, p. 307.
Artemisia vulgaris.

flavula, Forda Rohwer, 1908. Pysche, XV, p. 68.
Grass roots *(Gramineae).*

flavus, Euceraphis Davidson, 1912. Jour. Econ. Ent., V, p. 406, fig.
Alnus rhombifolia.

flavus, Hyalopterus Schouteden, 1906. Mem. Soc. Ent. Belg., XII, p. 230.
Aquilegia vulgaris, Rosa sp.

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flavus, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 133.
Picea abies.
For description in German see Zool. Anz. XVIII, 1895, p. 102.

flavus, Sipha (Forbes), 1884. Thirteenth Rept. Nox. & Ben. Insects, Ill., p. 42, fig. **Chaitophorus.**
Avena sativa, Digitaria sanguinalis, Echinochloa crus-galli, Phleum pratense, Poa pratensis, Sorghum dora, S. halepense, S. saccharatum, Setaria glauca, Zea mays.

flocculosa, Lachnus Williams, 1911. Aphididae of Nebraska, p. 22.
Pinus ponderosa.

flocculosa, Pterocomma (Weed), 1891. Insect Life, III, p. 291, fig. **Melanoxanthus.**
Salix cinerea.

floccus, Chermes Patch, 1909. Psyche, XVI, p. 137.
Picea marina, P. rubra, Pinus strobus.

florentina, Phylloxera Targioni-Tozzeti, 1875. Bul. Soc. Ent. Ital., VII, p. 287.
Quercus farnetto, Q. ilex, Q. sessilifolia.

floris-rapae, Aphis Curtiss, 1842. Jour. Royal Agr. Soc., III, p. 55.
Brassica oleracea.

foae, Phylloxera Börner, 1909. Zool. Anz., XXXIV, p. 26.
Quercus robur.

fodiens, Schizoneura Buckton, 1881. Mon. Brit. Aphides, III, p. 94, fig.
Bromus arienarius?, Ribes nigrum.

foeniculi, Siphocoryne Passerini, 1860. Gli Afidi, p. 37.
Conium maculatum, Daucus carota, Foeniculus vulgare, Pastinaca sativa.

follicularius, Pemphigus Passerini, 1861. Atti Soc. Ital. Sci. Nat. III, p. 400.
Pistacia terebinthis.

folsomii, Aphis Davis, 1908. Ent. News, XIX, p. 143, fig.
Psedera quinquefolia.

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forbesi, Aphis Weed, 1889. Bul. Ohio Agr. Exp. Sta., II, No. 6, p. 148, fig.
Fragaria sp.

forcata, Phylloxera (Shimer). Is a wrong citation of foveatum. (According to Pergande). Proc. Dav. Acad. Sci., IX, p. 209, 1904.

formicaria, Forda Heyden, 1837. Ent. Beitr. Mus. Senk., II, p. 292.
Agropyron repens, Cynodon dactylon, Festuca ovina—duriuscula Holcus lanatus, H. mollis, Lolium perenne, Poa pratensis, Sonchus oleraceus.

formicarium, Macrosiphum Theobald, 1913. The Ent. Record, XXVII, p. 55.
In nest of Lasius flavus.

formicarius, Pemphigus Walsh, 1862. Proc. Ent. Soc. Phil., I, p. 308.
Food plant not given. Found in ant's nest.

formicetorum, Pemphigus Walsh., 1862. Proc. Ent. Soc. Phil., I, p. 308.
Food plant not given. Found in ant's nest.

formicina, Endeis Buckton, 1883. Mon. Brit. Aphides, IV, p. 91, fig.
Carex dioica.

formicophilus, Lachnus Buchton, 1901. Science Gossip, VII, p. 257.
In ant's nest.

foveatum, Phylloxera (Shimer), 1869. Trans. Amer. Ent. Soc., II, p. 393. **Dactylosphaera.**
Carya cordiformis.

foveola, Phylloxera Pergande, 1904. Proc. Daven. Acad. Sci., IX, p. 200.
Carya glabra.

foveolata, Aphis Del Guercio, 1916. Redia, XI, p. 302, fig.
Pergularia extensa.

fragaefolii, Myzus Cockerell, 1901. Can. Ent. XXXIII, p. 101.
Fragaria sp.

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fragariae, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 431.
Fragaria vesca.

fragariae, Macrosiphum (Koch) 1855. Die Pflanzenläuse Aphiden, p. 173, fig. **Siphonophora.**
Duchesnea indica, Fragaria vesca.

fragariae, Macrosiphum Koch, var. **immaculata,** (Riley), 1875. Rural World for December 11. **Siphonophora.**
Fragaria sp.?

fragariae, Myzus Theobald, 1912. The Entomologist, p. 223.
Fragaria vesca.

fragariella, Macrosiphum (Theobald), 1905. Rept. Econ. Zool. p. 36. **Siphonophora.**
Fragaria vesca.

frangulae, Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 142, fig.
Rhamnus frangula, R. lanceolata.

fraxini, Aphis Fabricius, 1776. Genera Insectorum, p. 303.
Fraxinus excelsior.

fraxini, Pemphigus Hartig, 1841. Germars Zeit. Entom., III, p. 367.
Fraxinus sp.?

fraxini, Phylloxera Stebbins, 1910. Springfield Mus. Nat. Hist. Bul. 2, p. 46, fig.
Fraxinus americanus.

fraxini Prociphilus (Linnaeus), 1758. Systema Naturae, Tenth Edition, p. 454. **Chermes.**
Fraxinus americana, F. excelsior, F. oregona, F. quadrangulata, Syringa vulgaris, Ulmus americana.

fraxini-dipetalae, Prociphilus (Essig), 1911. Pomona Coll. Jour Ent. III, p. 533. **Pemphigus.**
Fraxinus dipetala, Pseudotsuga douglassi.

fraxinifolii, Prociphilus (Riley), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 17. **Pemphigus.**
Fraxinus americana.

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fraxinifolii, Prociphilus (Thomas), 1879. Eighth Rept. State Ent. Ill., p. 146. Pemphigus.
Fraxinus nigra, F. oregona, F. quadrangulata, F. sambucifolia

frequens, Aphis Walker, 1848. The Zool. VI, p. 2219.
Artemisia maritima.

***freycinetiae, Cerataphis** Van Der Goot, 1915. Beitr. Kenntn. Holland Blat. Harrlem, p. 434.
New name for **Cerataphis lataniae** (Lichtenstein) Van Der Goot, 1912. Tijd. Ent. LV, p. 330.

frigidae, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 46.
Artemisia californica, A. frigida.

frigidae, Macrosiphum (Oestlund), 1886. Aphididae of Minnesota, p. 20. Siphonophora.
Artemisia californica, A. frigida.

frondosae, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 38.
Bidens frondosa.

fuliginosa, Schizoneura Buckton, 1881. Mon. Brit. Aphides, III, p. 96, fig.
Pinus laricis, P. pyreniaca, P. sylvestris.

fuliginosus, Lachnus Buckton, 1891. Ind. Mus. Notes, II, p. 41, fig.
Prunus armeniaca, P. persica.

fulvae, Macrosiphum (Oestlund), 1887. Aphididae of Minnesota, p. 80. Nectarophora.
Impatiens biflora, I. pallida.

fumariae, Aphis Blanchard, 1840. Hist. Nat. Ins., III, p. 207.
Fumaria officinalis.

fumipennella, Monellia (Fitch), 1855. First. Rept. Nox. & Ben. Insects N. Y., p. 166. Aphis.
Carya sp., Juglans sp.

funesta, Macrosiphum (Macchiati), 1885. Bul. Soc. Ent. Ital., XVII, p. 67. Siphonophora.
Rubus idaeus?

fungicola, Eriosoma Walsh, 1862. Proc. Ent. Soc. Phil., I, p. 304.
Fungus?

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funitectus, Chermes Drefus, 1888. 61 Vers. Deutcher. Nat. Argt. Koln., part 2, p. 60.
Picea abies, Tsuga canadensis.

furcata, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 259, fig.
Prunus virginiana.

furcata, Forda Theobald, 1913. The Ent. Record, XXVII, p. 53.
In nest of Myrmica laevinodis.

furcipes, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 361.
Bellis perennis, Primula veris.

furcula, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 312.
Betula sp., Salix sp.

fusciclava, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev. I, p. 361.
Food plant not given.

fuscicornis, Amycla Koch, 1857. Die Pflanzenläuse Aphiden, p. p. 303, fig.
Anthemis nobilis, Camelia sp., Chenopodium sp.

fuscifrons, Amycla Koch, 1857. Die Pflanzenläuse Aphiden, p. 301, fig.
Avena sativa, Camellia sp., Coix lacryma-jobi, Hieracium pilosella, Panicum sp. See **P. radicum** Boyer.

fuscifrons, Pemphigus var. **saccharata,** Del Guercio, 1895. Nat. Sicil. XIV, p. 88.
Sorghum saccharatum.

fuscipennis, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 312.
"Hab in Lapponiae Suecicae meridionalis, sylvis, rarissime, etc."

fuscus, Lachnus Passerini 1863. Arch. Zool. Anat. II, p. 188.
Quercus sp.

galeactitis, Rhopalosiphum Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 233.
Antirrhinum majus, Galeactites tomentosa.

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galeopsidis, Phorodon (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 35. **Aphis.**
Galeopsis ladanum, G. tetrahit, Heraclium spondylium, Lamium album, L. amplexicaule, L. purpureum, Leonurus cardiaca, Petasites japonicus, Plantago lanceolata, P. psyllium, Polygonum aviculare, P. donii, P. fagopyrum, P. hydropiper, P. hydropiperoides, P. lapathifolium, P. mite, P. pennsylvanicum, P. persicaria, Potentilla anserinia, P. reptans, P. verna, Stachys arvensis, S. germanica, S. recta, S. sylvatica, Tussilago farfare.

galii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 87.
Galium aparine, G. cruciata, G. molluga, G. saccharatum, G. verum.

gallarum, Aphis Gmelin, 1788. Systema Naturae, I, part 4, p. 2210.
Abies sp.? Picea mariana.

gallarum, Aphis Kaltenbach, 1856. Verh. Natur. Ver. Preuss. Rhein, West., p. 236.
Artemisia abrotanum, A. vulgaris.

gallarum-ulmi, Aphis Linnaeus, 1789. Entomologia, p. 550, no. 41.
Ulmus sp.

gallicae, Anuraphis (Del Guercio), 1911. Redia, VII, p. 311. **Aphis.**
Filago gallica, F. germanica.

gardeniae, Aphis Del Guercio, a var. of **Aphis affinis** Del G. which see.

gaurae, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 79. **Siphonophora.**
Gaura parviflora.

gaurina, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 80. **Siphonophora.**
Gaura parviflora.

gei, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 171, fig. **Siphonophora.**
Geum urbanum.

genevei, Callipterus Sanborn, 1904. Kansas Aphididae, p. 38.
Food plant not given.

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geniculatus, Chermes Ratzeburg, 1844. Die Forst-Insecten, III, p. 202. Foot note.
Larix decidua.

genistae, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 144.
Genista tinctoria.

genistae, Aphis Scopoli, 1763. Entomologia Carniolica, p. 139.
Cytisus laburnum, Foeniculum vulgare, Genista tinctoria.

genistae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 90.
Genista angelica, G. tinctoria.

georgiana, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 249.
Carya illinoensis.

geranii, Aphis Kaltenbach, 1874. Die Pflanzenfeinde, p. 81.
Geranium maculatum, G. robertianum.

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Gerardia tenuifolia, Ostrya virginica.

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Alnus glutinosa, A. incana.

gigliolii, Cavariella Del Guercio, 1911. Redia, VII, p. 326.
Angelica silvestris.

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Amaranthus retroflexus, Helianthus petiolaris.

gillettei, Euceraphis Davidson, 1915. Jour. Econ. Ent., VIII, p. 421.
Alnus rhombifolia, Betula fontinalis.

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githago, Macrosiphum Theobald, 1913. N. N. for **Siphonophora cichorii,** Buckton (part) not Koch, Jour. Econ. Biol., VIII, No. 3, p. 147.
Agrostemma githago, Cichorium intybus.

glabra, Vacuna Heyden, 1837, Ent. Beitr. Mus. Senk., II, p. 291.
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Glaucium sp.

glechomae, Aphis Walker, 1848. The Zool. VI, p. 2247.
Nepeta glechoma.

glehnus, Lachnus Essig, 1916. Jour. Ent. & Zool. Claremont, Cal., VII, p. 180. fig.
Picea glehni.

globosum, Phylloxera (Shimer), 1867. Proc. Acad. Nat Sci. Phil., XIX, p. 2. **Dactylosphaera.**
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Rumex sp.? Scarlet runner?

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Populus sp.

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glyceriae, Sipha (Kaltenbach) 1843. Mon. der Pflanzenläuse, p. 113. Aphis.

Dactylis sp., Festuca sp., Glyceria aquatica, G. fluitans, Juncus effusus, J. lampocarpus, Leersia oryzoides, Oryza sativa, Phalaris arundinacea, Phleum pratense, Poa annua, Sagittaria sagittifolia, Triticum sp.

glyceriae, Sipha var. **italica,** Del Guercio, 1905. Redia, II, p. 142, fig.

Agrostis sp., Alopecurus sp.

gnaphalii, Aphis Walker, 1849. The Zool. VII, p. 50, app.

Filago germanicum.

gnaphalii, Pemphigus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 180.

Filago germanica, Gnaphalium erectum.

gnidii, Macrosiphum (Lichtenstein), 1884. La Flore das Aphidens, p. 22. No description. **Siphonophora.**

Daphne sp.

gomphorocarpi, Aphis Van Der Goot, 1912. Mitteilungen aus dem Naturhistorischen Museum, XXIX, p. 275.

Gomphorocarpus fructicosus.

gossypii, Aphis Glover, 1877. Report Comm. Agr., U. S. A., 1876, p. 36.

Acalypha virginica, Althaea sp., Amaranthus sp., Arctium lappa, Asparagus officinalis, Begonia sp., Beta vulgaris Bidens sp., Capsella bursa-pastoris, Catalpa sp., Chenopodium album, C. ambrosioides, Cirsium arvensis, Citrus aurantium, Colocasia antiquorum, Convolvulus sp., Cornus mas, Cosmia sp., Cucumis melo, C. sativus, Cucurbita maxima, Cuphea, Datura stramonium, Diodia teres, Duchesnea indica, Gossypium herbaceum, Hibiscus rosa-sinensis, Humulus lupulus, Hydrangea sp., Ipomoea sp., Lappa major, Lepidium virginicum, Lilium candidum, Lycopersicum esculentum, Malva rotundifolia, Medicago denticulata, Nepeta hederacea, Phaseolus lunatus, P. ranus, P. vulgaris, Philadelphus coronarius, Plantago virginica, Portulaca oleracea, Pyrus communis, P. coronaria, Rumex crispus, Saccharum officinarum, Solanum tuberosum, Spinacia oleracea, Stellaria media, Taraxacum officinale, Trifolium pratense, Vicia faba, Viola odorata.

gossypii, Acyrthosiphon Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., App. p. 7.

Gossypium sp.

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gossypii, Acyrthosiphon Mordwilko, sub. sp. gossypii, Mordwilko, Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 173.
Gossypium sp.

gossypii, Acyrthosiphon Mordwilko, sub. sp. paczoskii, Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., p. 178.
Lepidium perfoliatum.

grabhami, Rhopalosiphum Cockerell, 1903. Can. Ent., XXXV, p. 342.
Lonicera involucrata.

gracilis, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1040.
Salix sp.

gracilis, Myzus Buckton, 1876. Mon. Brit. Aphides, I, p. 176, fig.
Acer pseudo-platanus, Platanus sp.

graffii, Stomaphis Cholodkovsky, 1894. Bul. Soc. Imp. Nat. Mus., VIII, p. 401, fig.
Acer campestre, A. tataricum.

graminis, Chermes Linnaeus, 1758. Systema Naturae, p. 453, No. 1.

graminis, Tetraneura Monell, 1882. Can. Ent., XIV, p. 16.
Deschampsia ambigua, D. caespitosa, Leersia virginica, Panicum teneriffae, Triticum vulgare, Ulmus americana.

graminis, Tychea Koch, 1857. Die Pflanzenläuse Aphiden, p. 298, fig.
Anthoxanthum odoratum.

graminum, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 3, p. 145.
Wild grasses,—meadow foxtail, timothy grass.

graminum, Toxoptera Rondani, 1852. Nuov. Ann. Sci. Nat. Rend. ser. 3, VI, p. 10.
Agropyron occidentale, A. repens, A. smithii, A. tenerum, Alopecurus geniculatus, Arrhenatherum avenaceum, Avena barbata, A. fatua, A. sativa, Bromus commutatus, B. erectus, B. hordeaceous, B. inermis, B. maximum, B. porteri B. secalinus, B. tec-

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glyceriae, Sipha (Kaltenbach) 1843. Mon. der Pflanzenläuse, p. 113. **Aphis.**

Dactylis sp., Festuca sp., Glyceria aquatica, G. fluitans, Juncus effusus, J. lampocarpus, Leersia oryzoides, Oryza sativa, Phalaris arundinacea, Phleum pratense, Poa annua, Sagittaria sagittifolia, Triticum sp.

glyceriae, Sipha var. **italica,** Del Guercio, 1905. Redia, II, p. 142. fig.

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Filago germanicum.

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gossypii, Acyrthosiphon Mordwilko, 1914. Fa[illegible] secta Hemiptera), I, Petrograd., Apr[illegible]

Gossypium sp.

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gossypii, Acyrthosiphon Mordwilko, sub. sp. gossypii, Mordwilko, Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 173.
Gossypium sp.

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Wild grasse… …dow f… …mothy grass.

graminu… …Nuov. Ann. Sci. Nat. Rend.

…*A. smithii, A. tenerum, Alope-*
…*eum, Avena barbata,*
…*. erectus, B. hordea-*
…*B. secalinus, B. tec-*

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torum, B. unioloides, Chaetochloa dactylon, C. viridis, Cynodon dactylon, Dactylis glomerata, Digitalis sanguinalis, Distichlis spicata, Echinochloa crus-galli, Eleusine indica, Elymus canadensis, E. striatus, E. virginicus, Eragrostis megastachya, E. pilosa, Fagopyrum esculentum, Festuca elatior, F. heterophylla, F. ovina-duriuscula, F. rubra, Heteropogon hirtus, Hordeum caespitosum, H. jubatum, H. murinum, H. pusillum, H. vulgare, Juncus tennis, Lolium multiflorum, L. perenne, L. temulentum, Medicago sativa, Phalaris canariensis, Phleum pratense, Poa annua, P. compressa, P. pratensis, Polypogon monspeliensis, Secale cereale, Setaria glauca, S. italica, Sorghum halepense, S. vulgaris, Sporobolus neglectus, Stipa setigera, S. viridula, Triticum sativum, T. spelta, T. villosum, T. vulgare, Zea mays.

graminus, Schizoneura Del Guercio, 1895. Natural. Sicil. XIV, p. 84.
Triticum vulgare.

granarium, Macrosiphum (Kirby), 1798. Trans. Linn. Soc. London, IV, p. 238. **Aphis.**
Agropyron repens, Avena fatus, A. sativa, Bromus commutatus? B hordeaceous, B. secalinus, Chaetochloa glauca, Dactylis glomerata, Echinochloa crus-galli, Eleusine indica, Elymus canadensis, E. virginicus, Festuca heterophylla, F. ovina-duriuscula, F. tectorum, Frageria grandiflora, Glyceria fluitans, Holcus sp., Hordeum jubatum, H. murinum, H. pusillum, H. vulgare, Juncus tenuis, Lolium multiflorum, Poa compressa, P. pratensis, Polygonum sp., Secale cereale, Seteria glauca, S. italica, Syntherisma sanguinale, Triticum sativum, T. vulgare, Zea mays.

granulatus, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 13, fig.
Acer campestre

gravicornis, Pemphigus Patch, 1913. Me. Agr. Exp. Sta. Bul. No. 213, p. 75, fig.
Populus balsamifera.

greeni, Lachnus Schouteden, 1905. Spolia Zeylanica, II, p. 184, fig.
Cryptomeria sp.

grindeliae, Atarsos Gillette, 1911. Ent. News, XXII, p. 440, fig
Grindelia squarrosa.

grindeliae, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 81. **Siphonophora.**
Grindelia squarrosa.

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groenlandica, Tychea Rübsaamen, 1898. Bibl. Zool. XX, p. 115.
Grass roots.

grossulariae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 67.
Ribes grossularia, R. nigrum, R. sanguineum, R. vulgare.

grossulariae, Schizoneura Taschenberg, 1887. Verh. blatt. Deutsch. Pomol. Ver. p. 80.
Ribes sp.

grossus, Lachnus Kaltenbach, 1846. Ent. Zeit. Stettin, VII, p. 174.
Picea abies, Pinus sp.

hamadryas, Anisophleba Koch, 1857 Die Pflanzenläuse Aphiden, p. 320, fig.
Larix decidua.

hamamelidis, Hormaphis (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 69. **Byrsocrypta.**
Betula nigra, Hamamelis virginiana.

hederae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 89.
Hedera helix, Ilex aquilfolium.

hederae, Macrosiphum Theobald, 1915. Bul. Ent. Research, VI, p. 108, fig.
Hedera helix.

hederae, Pemphigus Horvath, 1894. Rev. Entom. France, XIII, p. 188, fig.
Hedera helix.

hederella, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 119, fig.
Hedera helix.

heleniella, Macrosiphum (Cockerell), 1903. Can Ent., XXXV, p. 169. **Nectarophora.**

helianthemi, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 65.
Helianthemum vulgare.

helianthemi, Rhizobius Westwood, 1843. Proc. Ent. Soc. Jour., also Ann. Nat. Hist., XIV, p. 453.
We have seen only the citation in the Gardners Chronicle for 1848, p. 399.
Helianthus tuberosus.

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funitectus, Chermes Drefus, 1888. 61 Vers. Deutcher. Nat. Argt. Koln., part 2, p. 60.
Picea abies, Tsuga canadensis.

furcata, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 259, fig.
Prunus virginiana.

furcata, Forda Theobald, 1913. The Ent. Record, XXVII, p. 53.
In nest of Myrmica laevinodis.

furcipes, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 361.
Bellis perennis, Primula veris.

furcula, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 312.
Betula sp., Salix sp.

fusciclava, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev. I, p. 361.
Food plant not given.

fuscicornis, Amycla Koch, 1857. Die Pflanzenläuse Aphiden, p. p. 303, fig.
Anthemis nobilis, Camelia sp., Chenopodium sp.

fuscifrons, Amycla Koch, 1857. Die Pflanzenläuse Aphiden, p. 301, fig.
Avena sativa, Camellia sp., Coix lacryma-jobi, Hieracium pilosella, Panicum sp. See P. radicum Boyer.

fuscifrons, Pemphigus var. **saccharata,** Del Guercio, 1895. Nat. Sicil. XIV, p. 88.
Sorghum saccharatum.

fuscipennis, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 312.
"Hab in Lapponiae Suecicae meridionalis, sylvis, rarissime, etc."

fuscus, Lachnus Passerini 1863. Arch. Zool. Anat. II, p. 188.
Quercus sp.

galeactitis, Rhopalosiphum Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 233.
Antirrhinum majus, Galeactites tomentosa.

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galeopsidis, Phorodon (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 35. **Aphis.**
Galeopsis ladanum, G. tetrahit, Heraclium spondylium, Lamium album, L. amplexicaule, L. purpureum, Leonurus cardiaca, Petasites japonicus, Plantago lanceolata, P. psyllium, Polygonum aviculare, P. donii, P. fagopyrum, P. hydropiper, P. hydropiperoides, P. lapathifolium, P. mite, P. pennsylvanicum, P. persicaria, Potentilla anserinia, P. reptans, P. verna, Stachys arvensis, S. germanica, S. recta, S. sylvatica, Tussilago farfare.

galii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 87.
Galium aparine, G. cruciata, G. molluga, G. saccharatum, G. verum.

gallarum, Aphis Gmelin, 1788. Systema Naturae, I, part 4, p. 2210.
Abies sp.? Picea mariana.

gallarum, Aphis Kaltenbach, 1856. Verh. Natur. Ver. Preuss. Rhein, West., p. 236.
Artemisia abrotanum, A. vulgaris.

gallarum-ulmi, Aphis Linnaeus, 1789. Entomologia, p. 550, no. 41.
Ulmus sp.

gallicae, Anuraphis (Del Guercio), 1911. Redia, VII, p. 311. **Aphis.**
Filago gallica, F. germanica.

gardeniae, Aphis Del Guercio, a var. of **Aphis affinis** Del G. which see.

gaurae, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 79. **Siphonophora.**
Gaura parviflora.

gaurina, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 80. **Siphonophora.**
Gaura parviflora.

gei, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 171, fig. **Siphonophora.**
Geum urbanum.

genevei, Callipterus Sanborn, 1904. Kansas Aphididae, p. 38.
Food plant not given.

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Genista tinctoria.

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Cytisus laburnum, Foeniculum vulgare, Genista tinctoria.

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Carya illinoensis.

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Geranium maculatum, G. robertianum.

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Solidago canadensis, S. odora.

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Alnus glutinosa, A. incana.

gigliolii, Cavariella Del Guercio, 1911. Redia, VII, p. 326.
Angelica silvestris.

gillettei, Aphis Cowen, 1895. Hemiptera of Colo., p. 120.
Amaranthus retroflexus, Helianthus petiolaris.

gillettei, Euceraphis Davidson, 1915. Jour. Econ. Ent., VIII, p. 421.
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Agrostemma githago, Cichorium intybus.

glabra, Vacuna Heyden, 1837, Ent. Beitr. Mus. Senk., II, p. 291.
Quercus sp.

gladioli, Aphis Felt, 1908. Twenty-fourth Rept. State Ent. Inj. Insects, N. Y., Mus. Bul. 134, p. 19, fig.
Gladiolus sp., Nepeta glechoma.

glandiformis, Pemphigus Rudow, 1875. Zeit. Ges. Naturv. (2), XII, Mecklenberg, p. 247.
Populus pyramidalis.

glandulosa, Aphis Kaltenbach, 1846. Ent. Zeit. (Stettin), VII, p. 170.
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glechomae, Aphis Walker, 1848. The Zool. VI, p. 2247.
Nepeta glechoma.

glehnus, Lachnus Essig, 1916. Jour. Ent. & Zool. Claremont, Cal., VII, p. 180. fig.
Picea glehni.

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Carya cordiformis, C. glabra.

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Populus sp.

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Gomphorocarpus fructicosus.

gossypii, Aphis Glover, 1877. Report Comm. Agr., U. S. A., 1876, p. 36.

Acalypha virginica, Althaea sp., Amaranthus sp., Arctium lappa, Asparagus officinalis, Begonia sp., Beta vulgaris Bidens sp., Capsella bursa-pastoris, Catalpa sp., Chenopodium album, C. ambrosioides, Cirsium arvensis, Citrus aurantium, Colocasia antiquorum, Convolvulus sp., Cornus mas, Cosmia sp., Cucumis melo, C. sativus, Cucurbita maxima, Cuphea, Datura stramonium, Diodia teres, Duchesnea indica, Gossypium herbaceum, Hibiscus rosa-sinensis, Humulus lupulus, Hydrangea sp., Ipomoea sp., Lappa major, Lepidium virginicum, Lilium candidum, Lycopersicum esculentum, Malva rotundifolia, Medicago denticulata, Nepeta hederacea, Phaseolus lunatus, P. ranus, P. vulgaris, Philadelphus coronarius, Plantago virginica, Portulaca oleracea, Pyrus communis, P. coronaria, Rumex crispus, Saccharum officinarum, Solanum tuberosum, Spinacia oleracea, Stellaria media, Taraxacum officinale, Trifolium pratense, Vicia faba, Viola odorata.

gossypii, Acyrthosiphon Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., App. p. 7.

Gossypium sp.

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gossypii, Acyrthosiphon Mordwilko, sub. sp. gossypii, Mordwilko, Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 173.
Gossypium sp.

gossypii, Acyrthosiphon Mordwilko, sub. sp. paczoskii, Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., p. 178.
Lepidium perfoliatum.

grabhami, Rhopalosiphum Cockerell, 1903. Can. Ent., XXXV, p. 342.
Lonicera involucrata.

gracilis, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1040.
Salix sp.

gracilis, Myzus Buckton, 1876. Mon. Brit. Aphides, I, p. 176, fig.
Acer pseudo-platanus, Platanus sp.

graffii, Stomaphis Cholodkovsky, 1894. Bul. Soc. Imp. Nat. Mus., VIII, p. 401, fig.
Acer campestre, A. tataricum.

graminis, Chermes Linnaeus, 1758. Systema Naturae, p. 453, No. 1.

graminis, Tetraneura Monell, 1882. Can. Ent., XIV, p. 16.
Deschampsia ambigua, D. caespitosa, Leersia virginica, Panicum teneriffae, Triticum vulgare, Ulmus americana.

graminis, Tychea Koch, 1857. Die Pflanzenläuse Aphiden, p. 298, fig.
Anthoxanthum odoratum.

graminum, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 3, p. 145.
Wild grasses,—meadow foxtail, timothy grass.

graminum, Toxoptera Rondani, 1852. Nuov. Ann. Sci. Nat. Rend. ser. 3, VI, p. 10.
Agropyron occidentale, A. repens, A. smithii, A. tenerum, Alopecurus geniculatus, Arrhenatherum avenaceum, Avena barbata, A. fatua, A. sativa, Bromus commutatus, B. erectus, B. hordeaceous, B. inermis, B. maximum, B. porteri B. secalinus, B. tec-

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torum, B. unioloides, Chaetochloa dactylon, C. viridis, Cynodon dactylon, Dactylis glomerata, Digitalis sanguinalis, Distichlis spicata, Echinochloa crus-galli, Eleusine indica, Elymus canadensis, E. striatus, E. virginicus, Eragrostis megastachya, E. pilosa, Fagopyrum esculentum, Festuca elatior, F. heterophylla, F. ovina-duriuscula, F. rubra, Heteropogon hirtus, Hordeum caespitosum, H. jubatum, H. murinum, H. pusillum, H. vulgare, Juncus tennis, Lolium multiflorum, L. perenne, L. temulentum, Medicago sativa, Phalaris canariensis, Phleum pratense, Poa annua, P. compressa, P. pratensis, Polypogon monspeliensis, Secale cereale, Setaria glauca, S. italica, Sorghum halepense, S. vulgaris, Sporobolus neglectus, Stipa setigera, S. viridula, Triticum sativum, T. spelta, T. villosum, T. vulgare, Uea mays.

graminus, Schizoneura Del Guercio, 1895. Natural. Sicil. XIV, p. 84.
Triticum vulgare.

granarium, Macrosiphum (Kirby), 1798. Trans. Linn. Soc. London, IV, p. 238. **Aphis.**
Agropyron repens, Avena fatus, A. sativa, Bromus commutatus? B hordeaceous, B. secalinus, Chaetochloa glauca, Dactylis glomerata, Echinochloa crus-galli, Eleusine indica, Elymus canadensis, E. virginicus, Festuca heterophylla, F. ovina-duriuscula, F. tectorum, Frageria grandiflora, Glyceria fluitans, Holcus sp., Hordeum jubatum, H. murinum, H. pusillum, H. vulgare, Juncus tenuis, Lolium multiflorum, Poa compressa, P. pratensis, Polygonum sp., Secale cereale, Seteria glauca, S. italica, Syntherisma sanguinale, Triticum sativum, T. vulgare, Zea mays.

granulatus, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 13, fig.
Acer campestre

gravicornis, Pemphigus Patch, 1913. Me. Agr. Exp. Sta. Bul. No. 213, p. 75, fig.
Populus balsamifera.

greeni, Lachnus Schouteden, 1905. Spolia Zeylanica, II, p. 184, fig.
Cryptomeria sp.

grindeliae, Atarsos Gillette, 1911. Ent. News, XXII, p. 440, fig
Grindelia squarrosa.

grindeliae, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 81. **Siphonophora.**
Grindelia squarrosa.

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groenlandica, Tychea Rübsaamen, 1898. Bibl. Zool. XX, p. 115.
Grass roots.

grossulariae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 67.
Ribes grossularia, R. nigrum, R. sanguineum, R. vulgare.

grossulariae, Schizoneura Taschenberg, 1887. Verh. blatt. Deutsch. Pomol. Ver. p. 80.
Ribes sp.

grossus, Lachnus Kaltenbach, 1846. Ent. Zeit. Stettin, VII, p. 174.
Picea abies, Pinus sp.

hamadryas, Anisophleba Koch, 1857 Die Pflanzenläuse Aphiden, p. 320, fig.
Larix decidua.

hamamelidis, Hormaphis (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 69. Byrsocrypta.
Betula nigra, Hamamelis virginiana.

hederae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 89.
Hedera helix, Ilex aquilfolium.

hederae, Macrosiphum Theobald, 1915. Bul. Ent. Research, VI, p. 108, fig.
Hedera helix.

hederae, Pemphigus Horvath, 1894. Rev. Entom. France, XIII, p. 188, fig.
Hedera helix.

hederella, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 119, fig.
Hedera helix.

heleniella, Macrosiphum (Cockerell), 1903. Can Ent., XXXV, p. 169. Nectarophora.

helianthemi, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 65.
Helianthemum vulgare.

helianthemi, Rhizobius Westwood, 1843. Proc. Ent. Soc. Jour., also Ann. Nat. Hist., XIV, p. 453.
We have seen only the citation in the Gardners Chronicle for 1848, p. 399.
Helianthus tuberosus.

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helianthi, Aphis Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 26.
Cornus sp., Helianthus annuus, H. divaricatus, H. giganteus, H. grosse-serratus, H. petiolaris, H. scabberimus, H. tuberosus.

helichrysi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 102.
Achillea ligustica, A. millefolium, A. odorata, A. ptarmica, Ageratum conizoides, Anthemis tinctoria, Aster sp., Bidens frondosa, Bidens tripartita, Chrysanthemum balsamita, Erigeron canadensis? Gnaphalium uglinosum, Helichrysum arenarium, H. chrysanthemum, H. stoechas, Hieracium umbellatum, Lamium album, L. maculatum, L. purpureum, Leonurus cardiaca, Matricaria sp., Myosotis palustris, Prunus insititia, Senecio vulgaris, Tanacetum vulgare, Trifolium pratense.

heliotropii, Aphis Macchiati, 1885. Bul. Soc. Ent. Ital., XVII, p. 59.
Heliotropium europaeum.

hemisphericum, Phylloxera (Shimer), 1869. Trans. Am. Ent. Soc., II, p. 387. **Dactylosphaera.**
Carya alba.

heraclei, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 50, fig.
Aethusa cynapium, Apium graveolens, Arctium sp., Daucus carota, Heracleum spondilium.

heraclii, Aphis Cowen, 1895. Hemiptera of Colo., p. 120.
Heracleum lanatum, Pastinaca sativa.

hermistonii, Aphis Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 93, fig.
Artemesia tridentata.

heucherae, Macrosiphum (Thomas), 1879. Eighth Rept. State Ent. Ill., p. 66. **Siphonophora.**
Heuchera hartwegii, H. hispida.

hexagona, Forda Theobald, 1913. The Ent. Record, XXVII, p. 53.
In nest of *Formica fusca.*

hibernaculorum, Aphis Boyer de Fonscolombe, 1841. Anns. Soc. Ent. France, X, p. 181.
Daphne indica.

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hieracii, Macrosiphum (Schrank), 1801. Fauna Boica, II, p. 121. Aphis.

Arctium lappa, Ballota nigra, Carduus sp., Cichorium endiva. C. intybus, Crepis tectorum, Hieracium murorum, H. pilosella, H. spondylium, H. sylvaticum, H. sylvestris, Urospermum dalechampii, U. picroides.

hieracii, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 17. Aphis.

Arctium lappa, Cichorium intybus, Crepis biennis, Hieracium murorum, H. pilosella, H. spondylium, H. sylvaticum, H. sylvestris, H. umbellatum, H. vavietis.

hieracium-paniculatum, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 17.

Hieracium paniculatum.

hieracium-venosum, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic, Rev., I, p. 361.

Hieracium venosum.

himalayensis, Chermes Stebbing, 1910. Trans. Linn. Soc. London, ser. 2, Zool. XI, part 6, pp. 99–124, fig.

This name is adopted by the author to replace **Chermes abietis-piceae** Stebbing because he thinks the latter name will cause confusion if Cholodkovsky is right in his belief that two species are involved.

Abies webbiana, Picea morinda.

hippophaes, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1036.

No food plant given.

hippophaës, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 28, fig.

Elaeagnus sp., Hippopha rhamnoides, Inula graveolens, Polygonum nodosum, P. persicaria, Shepherdia sp.

hirtellus, Atheriodes Haliday, 1839. Ann. Mag. Nat. Hist., p. 189.

Juncus articulatus.

hirticornis, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, I, p. 447.

Quercus sp.

***holci, Aphis** Hardy, 1850. North British Agriculturist, II, p. 531.

Holcus sp.

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holci, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 62.
Holcus mollus.

hordei, Aphis Kyber, 1815. Germars Mag. Ent., I, part 2, p. 15
Hordeum vulgare.

hordei, Aphis Del Guercio, 1913. Redia, IX, p. 205.
Hordeum murinum.

horvathi, Trama Del Guercio, 1909. Redia, V, p. 252, fig.
Cichorium intybus, Leontodon taraxaci, Sonchus asperis, S. oleraceus.

houtenensis, Aphis Troop, 1906. Ent. News, XVII, p. 59.
Ribes rotundifolium, R. sanguineum.

howardii, Amphorophora Wilson, 1911. Can. Ent. XLIII, p. 59.
Dactylis glomerata, Elymus canadensis, E. virginicus, Glyceria nervata.

humilis, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1038.
No food plant given.

humuli, Phorodon (Schrank), 1801. Fauna Boica, II, p. 110. **Aphis.**
Asparagus officinalis, Humulus lupulus, Prunus domestica, P. insititia, P. mahaleb, P. pissardi, P. spinosa.

hyalinus, Lachnus Koch, 1857. Die Pflanzenläuse Aphiden, p. 238, fig.
Picea abies, Pinus sp.

hyalinus, Myzocallis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 30. **Callipterus.**
Quercus imbricaria, Q. lamellosa, Q. stellata.

hyosciami, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V, p. 149.
Hyoscyamus niger.

hyperici, Callipterus Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 25.
Hypericum kalmianum, H. prolificum.

hyperici, Myzocallis Thomas, 1879. Eighth Rept. State Ent. Ill., p. 108.
Hypericum prolificum.

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hyperophilus, Lachnus Koch, 1855. Die Pflanzenläuse Aphiden, p. 232, fig.
Pinus "maritima", P. sylvestris.

hypogeus, Chaitophorus Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 213.
Salix repens.

idaei, Aphis Van Der Goot, 1912. Tijdschr. voor Ent., 55, p. 78, fig.
Rubus idaeus.

ignotum, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 147.
Spiraea sp.

ilicicola, Pterochlorus (Boisduval), 1867. Entom. Hort., p. 272. **Aphis.**
Quercus ilex.

ilicina, Pterochlorus Del Guercio), 1909. Redia V, p. 271, fig. **Dryaphis.** Sinonimia esclusa for **Aphis ilicicola** Boisduval.
Quercus ilex.

ilicifphila, Pterochlorus (Del Guercio), 1909. Redia, V, p. 268, fig. **Dryaphis.**
Quercus ilex. Name given to replace Boisduval's name *A. ilicicola.*

ilicis, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 88.
Ilex aquifolium.

ilicis, Parthenophylloxera Grassi and Fra, 1911. Rend. Acc. Lincei, 20, 2 sem., pp. 611–617.
Quercus sp.?

ilka, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd, p. 149.
Papaver nudicaule.

incerta, Aphis Walker, 1849. The Zool. VII, p. 45, app.
Cucumis sativus.

illinoisensis, Aphis Shimer, 1866. Prairie Farmer, XVIII, No. 20, Nov. 17, p. 316.
Vitis cordifolia, V. vinifera, V. vulpina.

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imaicus, Pemphigus Cholodkovsky, 1912. Revue Russ. Ent., XII, p. 495, fig.
Populus ciliata.

imbricator, Pemphigus (Fitch), 1851. Rept. Reg. Univ. State N. Y., Cab. Nat. Hist., p. 68. **Eriosoma.**
Betula sp., Fagus sylvatica, F. grandifolia.

immaculata, Macrosiphum Riley, as a var. of **M. fragariae** Koch which see.

immunis, Pemphigus Buckton, 1896. Ind. Mus. Notes, IV, p. 51.
Populus tremuloides.

impacta, Aphis Walker, 1849. The Zool., VII, p. 48, app.
Sambucus nigra.

impatientis, Aphis Thomas, 1877. Ill. State Lab. Nat. Hist. Bul. 2, p. 12.
Impatiens biflora, I. pallida.

impatientis, Macrosiphum Williams, as a var. of **M. carnosa** Buckton, which see.

impingens, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1042.
Betula alba.

incerta, Aphis Walker, 1849. The Zool. VII, p. 45, app.
Juniperus communis.

incertus, Lachnus Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 203.
In a foot note on this page Schouteden gives the above name to replace **L. subterraneus** Del Guercio.

inculta, Aphis Walker, 1849. The Zool. VII, p. 43, app.
Apium graveolens.

incumbens, Aphis Walker, 1849. The Zool. VII, p. 35, app.
Ononis spinosa.

indecisa, Aphis Walker, 1849. The Zool. VII, p. 45, app.
Juniperus communis.

indicus, Pemphigus Kieffer, 1908. Marcellia, VII, p. 161.
Coreopsis sp., Fagus sp.

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indicum, Rhopalosiphum Van Der Goot, 1916. Records Indian Museum, XII, p. 1, fig.
Food plant unknown.

indistincta, Aphis Walker, 1849. The Zool. VII, p. 46, app.
Asparagus officinalis.

inducta, Aphis Walker, 1849. The Zool. VII, p. 35, app.
Ononis spinosa.

infaustus, Pemphigus Ferrari, as a var. of **P. spyrothecae** Passerini, which see.

inflatae, Pemphigus Del Guercio, 1911. Redia, VII, p. 303, fig.
Silene latifolia.

infuscata, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 77, fig.
Prunus spinosa.

inhaerens, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1041.
Betula sp.

inserta, Aphis Walker, 1849. The Zool. VII, p. 39, app.
Pyrus germanica.

insessa, Aphis Walker, 1849. The Zool. VII, p. 32, app.
Viola tricolor.

insignis, Myzocallis Ferrari, as a var. of **Myzocallis quercus** Kaltenbach which see.

insita, Aphis Walker, 1849. The Zool. VII, p. 39, app.
Cineraria sp., Pyrus germanica.

insititiae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 58, fig.
Prunus insititia.

instabilis, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 94, fig.
Epilobium montanum, E. parviflorum, Matricaria inodora.

insularis, Cerataphis Van Der Goot, 1912. Tijdschrift voor Entomologie, deel LV, p. 325.
Food plant unknown.

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insularis, Macrosiphum (Pergande), 1900. Proc. Wash. Acad. Sci., II, p. 515. **Nectarophora.**
Food plant unknown.

interjecti, Forda Cockerell, 1903. Psyche, X, p. 217.
Food plant not given.

intermedia, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 199.
Carya alba, C. ovata.

internata, Aphis Walker, 1849. The Zool. VII, p. 37, app.
Prunus domestica.

introducta, Aphis Walker, 1849. The Zool. VII, p. 57, app.
Reseda odorata.

intybi, Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 148, fig.
Cichorium endivia, C. intybus, Cynara cardunculus, Taraxacum officinale, Xeranthemum sp.

inulae, Aphis Walker, 1849. The Zool. VII, p. 45.
Inula dysenterica.

inulae, Macrosiphum (Ferrari) 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 57. **Siphonophora.**
Inula viscosa.

inulae, Phorodon Passerini, 1860. Gli Afidi, p. 34.
Adenostyles albida, Galactites tomentosa, Inula conyza, I. graveolens, I. viscosa, Pulicaria sp., Tussilago farfara.

iridis, Aphis Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir. II, p. 129.
Iris florentina.

isatidis, Aphis Boyer de Fonscolmbe, 1841. Ann. Soc. Ent. France, X, p. 165.
Isatis tinctoria.

italicae, Sipha Del Guercio, as a var. of S. **glycerae** Kaltenbach which see.

jaceae, Macrosiphum (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Anchusa officinalis, Arenaria sp., Campanula trachelium, Carduus acanthoides, C. crispus, C. nutans, Centaurea cyanus, C. jacea,

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C. maculosa, C. nigra, C. nigrescens, C. scabiosa, Cichorium intybus, Cirsium arvense, C. muticus, C. palustre Crepis biennis, Echinospermum lappula, Echium vulgare, Hieracium murorum, Hypochoeris maculata, Inula helenium, I. squarrosa, Lactuca virosa, Lithospermum arvense, L. fruticosum, L. officinale, Onopordon achantium, Pulmonaria officinalis, Ruta graveolens, Scabiosa arvensis, Senecio viscosus, S. vulgaris, Sonchus oleraceus.

***jacobaeae, Aphis** Walker, 1850. The Zoologist, VIII, p. 54, app.
Senecio jacobaeae.

jacobaeae, Aphis Schrank, 1801. Fauna Boica, II, p. 123.
Senecio jacobaeae, S. sarracenicus, S. vulgaris.

jacobea-balsamita, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 16.
Senecio jacobaea.

jani, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 73.
No food plant given.

jasmini, Macrosiphum (Clarke), 1903. Can. Ent., XXXV, p. 252. Nectarophora.
"Jasmine"

juglandicola, Chromaphis (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 151. Lachnus.
Juglans nigra, J. regia.

juglandicola, Callipterus Koch, 1855. Die Pflanzenläuse Aphiden, p. 224. fig.
Juglans regia.

juglandiana, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, I, p. 335.
Juglans nigra, J. regia.

juglandis, Aphis Blanchard, 1840. Hist. Nat. Ins. III, p. 205, fig.
Juglans regia.

juglandis, Callipterus (Goeze), 1778. Entomologische Beitrage. II, p. 311. Aphis.
Juglans regia.

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jujubae, Rhizobius Buckton, 1899. Ind. Mus. Notes, IV, p. 277.
Zizyphus jujuba.

junackianus, Myzus Karsch, 1887. Berlin Ent. Zeit., XXXI, p. XXI.
Aconitum cammarum, A. lycoctonum.

juniperi, Lachnus var. **signata,** Del Guercio, 1909. Redia, V, p. Aphis.
Juniperus communis.

juniperi, Lachnus var. **signata,** Del Guercio, 1909. Redia, V, p. 314, fig.
Thuja occidentalis.

juniperinus, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 134.
Juniperus communis, Thuga occidentalis.
For description in German see Zool. Anz. XVII, p. 102.

kahawaluokalani, Myzocallis Kirkaldy, 1907. Proc. Hawaii Ent. Soc., I, part 3, p. 101.
Lagerstroemia indica.

kaltenbachii, Macrosiphum Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 239.
New name for **Siphonophora allariae** Koch.
Lactuca macrophylla, Sisymbrium alliaria.

kamtshatkanum, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd, p. 144.
Kamtshatka orientalis.

karschii, Schizoneura Lichtenstein, 1886. Entom. Nachr., XII, p. 82.
Artemisia campestris.

kingii, Forda Cockerell, 1903. Psyche, X, p. 216.
Grass roots in nest of ants.

kirgiz, Acyrthosiphum Mordwilko, as a sub. sp. of **A. sibircium** Mordwilko, which see.

kirkaldyi, Macrosiphum Fullaway, 1910. Rept. Hawaii Agr. Exp. Sta., (1909) p. 23, fig.
Acrostichum reticulatum.

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kochi, Aphis Schouteden, 1903. Ann. Soc. Ent. Belg., XLVII, p. 185.
New name for **Aphis pyri** Koch not Boyer.
Cydonia vulgaris, Pyrus sp.

kochii, Macrosiphum (Ferrari), 1872. Ann. Mus. Civ. Stor. Nat., Genova, III, p. 212. **Siphonophora.**
New name for **Macrosiphum artemisiae** Koch.

kochii, Schizoneura Lichtenstein, 1885. Les Pucerons, p. 30.
New name for **Schizoneura corni** (Fab.) Koch. No description.
Cornus sanguinea.

korotnewi, Brachycolus Mordwilko, 1901. Horae Soc. Ent. Ross., XXXIII, p. 350, fig.
Lolium sp., Triticum vulgare.

kuwanae, Trichosiphum Pergande, 1906. Ent. News, XVII, p. 209.
Quercus acuta, Q. serrata.

laburni, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 85.
Cytisus laburnum, C. scoparius, Portulaca oleracea.
Robinia, pseudo-acacia.

lactea, Pachypapa Tullgren, 1909. Arkiv. Zool. V, No. 14, p. 69, fig.
Populus tremula.

lactucae, Macrosiphum (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Crepis viridis, Lactuca oleracea, L. perennis, L. scariola, L. virosa, Solanum tuberosum, Sonchus oleraceus.

lactucae, Macrosiphum (Passerini), 1860. Gli Afidi, p. 34. **Siphonophora.**
Lactuca scariola, L. virosa.

lactucae, Rhizobius Fitch, 1871. Fourteenth Rept. Nox. & Ben. Insects, N. Y., p. 360.
Lactuca scariola.

lactucae, Rhopalosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 37. **Aphis.**
Cichorium endiva, Cineraria sp., Crepis tectorum, Cucurbitis pepo, Lactuca oleracea, L. scariola, Lapsana communis, Picris echioides, P. hieracioides, Ribes grossularia, R. nigrum, R. vulgare, Sonchus arvensis, S. asperis, S. oleraceus.

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***lactucarius, Pemphigus** Passerini, 1856. Giornale Giardini, III, p. 262.
Chenopodium album, Cheiranthus cheiri, Lactuca scariola, Populus sp.? Sonchus oleraceus.

lactucellum, Rhopalosiphum Theobald, 1915. Bul. Ent Research, VI, p. 115, fig.
Lactuca sp., Prunus persica.

lactucae, Pemphigus Westwood, 1849. The Gardeners Chronicle, p. 548, figs. 1–7.
Lactuca sp.

laevigatae, Macrosiphum Essig, 1911. Pom. Coll. Jour. Ent, III, p. 548, fig.
Salix laevigata.

lagerströmiae, Aphis Lichtenstein, 1884. La Flora des Aphidens, p. 32. No description.
Lagerstroemia indica.

lamii, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 85, fig.
Lamium purpureum, Urtica sp.

lamii, Macrosiphum Theobald, 1915. The Entomologist, p. 275.
Lamium purpureum.

lamii, Myzus Van Der Goot, 1912. Tijdschrift voor Entomologie, deel LV, p. 69.
Lamium purpureum.

lanata, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 311.
No food plant given and species not recognizable.

lanigera, Eriosoma (Hausman), 1802. Ill. Mag. Ins., I, p. 440. **Aphis.**
Crataegus coccinea, Planera sp., Prunus domestica, Pyrus (sorbus) americana, P. communis, P. coronaria, P. malus, Ulmus americana.

lanigera, Oregma (Zehntner), 1897. Archief. Java. Suiker Ind., X, V, p. 553. **Ceratovacuna.**
Saccharum officinarum.

lantanae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 105, fig.
Viburnum lantana, V. tinus.

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lanuginosa, Schizoneura Hartig, 1841. Zeit. Ent. (Germar) III, p. 367.
Planera sp., Ulmus campestris.

lapidarius, Lachnus (Fabricius), 1803. Systema Rhyngotorum, p. 306. Chermes.
Species not recognizable.

lappae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 50, fig.
Apium graveolens, Arctium minus, Daucus carota, Petasites albus.

lapponicus, Chermes Cholodkovsky, 1889. Zool. Anz., XII, p. 390.
Larix sp., Picea alba, P. abies, P. engelmanni, Pinus sp.

lapponicus, Chermes var. **praecox**, Cholodkovsky, 1897 (1898). Horae Soc. Ent. Ross., XXXI, p. 28, fig.
Picea abies, P. alba, P. engelmanni.

laricae, Periphyllus Halliday, 1868. Bul. Soc. Ent. France, VIII, p. 11, fig.
Larix sp.

lariciatus, Chermes Patch, 1909. Psyche, XVI, p. 137.
Larix laricina, Picea canadensis, Pinus strobus.

laricifex, Lachnus Fitch, 1858. Fourth Rept. Nox. & Ben. Insects, N. Y., p. 752.
Larix laricina.

laricifoliae, Chermes Fitch, 1858. Fourth Rept. Nox. & Ben. Insects, N. Y., p. 752.
Larix laricinia.

laricifoliae, Lachnus Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 102, fig.
Larix occidentalis.

laricina, Lachniella Del Guercio, 1909. Redia, V, p. 301, fig.
Larix decidua.

laricis, Adelges Vallot, 1836. Compt. Rend. Seanc. Acad. Sci., p. 72.
Larix sp.

laricis, cuneomaculata, Lachniella Del Guercio, 1909. Redia, V, p. 291, fig.
Larix decidua.

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laricis, Chermes Hartig, (1837). Jahresb. Forst. und Forstl. Naturk. im Jahre 1836 and 1837, pp. 643-648.
Larix sp.

laricis, Coccus (Bouche), Baerensprung, 1849. Zeit. Zool. Zoat. Paleoz. 1, p. 174.
Larix sp.

laricis, Eriosoma Mosely, 1841. Gardners Chronicle, p. 828.
Larix sp.

laricis, Lachnus Koch, 1857. Die Pflanzenläuse Aphiden, p. 241, fig.
Larix decidua.

laricis, Lachnus Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 102. Aphis.
Larix decidua, L. sibirica.

lasii, Tychea Cockerell, 1903. Psyche, X, p. 217.
In ants' nest. Food plant not given.

lata, Aphis Walker, 1850. The Zool. VII, p. 103, app.
Senecio vulgaris.

lataniae, Cerataphis (Boidsuval), 1867. Essai Ent. Hort., p. 355, fig. Coccus.
Acorus calamus, Calamus sp., Cattleya loddigesii, Coelia albiflora, Cynoglossum sp., Cypripedium sp., Dendrobium sp., Latania barbonica, Pritchardia sp., Sobralia sp., Vanda sp.

lateralis, Aphis Walker, 1848. The Zool. VI, p. 2251.
Prunus domestica, Senecio vulgaris.
Prunus domestica, Senecio vulgaris.

lathyri, Macrosiphum Moseley, Gardeners' Chronicle, I, p. 684. Aphis.
Lathyrus.

latysiphon, Amphorohpora Davidson, 1912. Jour. Econ. Ent., V, p. 408, fig.
Convolvulus arvensis, Vinca major.

lavaterae, Aphis Kittel, 1827. Me. Soc. Linn. Paris, V, p. 154.
Lavatera sp.

lazarewi, Abamalekia Del Guercio, 1906. Redia, III, p. 364.
Populus nigra, Quercus robur.

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leguminosae, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 121, fig.
Gleditschia triacanthos. Beans, cowpeas.

lentiginis, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 59, fig.
Pyrus communis.

lentisci, Aploneura Passerini, 1856. Giornale Giardini, III, p. 264.
Bromus hordeaceus, B. sterilis, Pistacia lentiscus.

leontodoniella, Aphis Theobald, 1913. Entomologists Record, XXVII, p. 54.
Taraxacum sp., in nest of **Lasius flavus.**

leontopodii, Aphis Schouteden, 1903. Ann. Soc. Ent. Belg., XLVII, p. 195.
Leontopodium alpinum.

leucanthemi, Macrosiphum (Scopoli), 1763. Entomologia Carniolica, p. 138. **Aphis.**
Matricaria sp.

leucanthemi, Macrosiphum (Ferrari), 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 214. **Siphonophora.**
Leucanthemum sp.

leucomelas, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 4, fig.
Populus alba, P. canadensis, P. italica, P. nigra, P. pyramidalis, Salix amygdaloides.

leucomelas, Chaitohporus Koch, var. **lyratus,** Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. di Genova, III, p. 232.
Populus nigra.

lichtensteini, Pemphigus Tullgren, 1909. Ark. Zool. V, No. 14, p. 148, fig.
New name for **P. bursarius** Lichtenstein, but not the one described by Linnaeus.
Populus sp.

lichtensteini, Phylloxera Balbiani, 1874. Compt. Rend. Seances Acad. Sci. LXXIX, part 2, p. 904.
Quercus sp.

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ligustici, Aphis Fabricius, 1781. Species Insectorum, II, p. 389.
Ligusticum scoticum.

ligustri, Aphis Mosley, 1841. Gardners Chronicle, p. 628.
Ligustrum sp.

ligustri, Rhopalosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 48. Aphis.
Evonymus europaeus, Ligustrum vulgare.

ligustriella, Aphis Theobald, 1914. Bul. Ent. Research, IV, p. 327, fig.
Ligrustrum sp.

ligustrinellum, Asiphum Koch, 1857. Die Pflanzenläuse Aphiden, p. 247, fig.
Ligrustrum vulgare.

lilacina, Macrosiphum (Ferrari), 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 216. Siphonophora.
Tanecetum vulgare.

lilicola, Aphis Williams, 1911. Aphididae of Nebraska, p. 43.
Lilium candidum.

lilii, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 33.
No description.
Lilium candidum.

lilii, Macrosiphum (Monell), 1879. Rept. U. S. Comm. Agri. p. 221. Siphonophora.
Lilium sp.?

linariae, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 33.
No description.
Linaria cymbalaria.

linariae, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 163, fig. Siphonophora.
Linaria vulgaris.

lineatum, Macrosiphum Van Der Goot, 1912. Tijdschrift voor Ent. deel LV, p. 59.
Artemisia vulgaris, Chrysanthemum frutescens.

liriodendri, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, p. 20. Siphonophora.
Liriodendron tulipifera.

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liriodendri, Macrosiphum (Monell) var. **rufa** (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, p. 20. **Siphonophora.**
Liriodendron tulipifera.

lithospermii, Aphis Wilson, 1915. Trans. Amer. Ent. Soc., XLI, p. 100, fig.
Lithospermum pilosum.

littoralis, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 44.
Gramineae.

longipennis, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 146, fig. **Siphonophora.**
Poa annua.

longipes, Pterochlorus (Dufour), 1833. Ext. de Mem. Savaus etran., IV, p. 115. **Aphis.**
Castanea sativa, Quercus cerris, Q. ilex, Q. robur, Q. sessilifolia.

longirostris, Aphis. Fabricius, 1787. Mantissa Insectorum, p. 314. In an ants' nest.
Acer campestre, A. negundo, Phaseolus vulgaris, Populus alba P. nigra, Quercus sp., Salix alba, S. viminalis, Thuja occidentalis.

longirostris, Lachnus (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 197. **Phylloxera.**
Quercus sp., Salix alba.

longirostris, Rhynchocles Altum, Forst Zoologie III, p. 356, fig.
Betula sp., Quercu sp.

longistigma, Lachnus Monell, 1878. Valley Naturalist, I, No. 6, p. 21. June.
For food plants see **L. caryae** Harris.

longitarsis, Lachnus Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 80.
Artemisia campestris, Phaseolus sp.

lonicerae, Aphis Mosley, 1841. Gardners Chronicle, p. 628.
Lonicera sp.

lonicerae, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 167.
Lonicera sp., Phalaris arundinacea.

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lonicerae, Chaitophorus Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 26.
Lonicera dioica.

lonicerae, Pemphigus Hartig, 1841. Zeit. Ent. (Germar) III, p. 367.
Lonicera xylosteum.

lonicerae, Siphocoryne (Siebold), 1839. Frorieps Notiz., Geb. Nat. und Hiel., XII, pp. 305–308. Aphis.
Lapsana communis, Lonicera japonica, L. periclemenum, L. tartarica, L. xylosteum.

lonicericola, Aphis Williams, 1911. Aphididae of Nebraska, p. 45.
Lonicera dioica.

longirostris, Cladobius Mordwilko as a var. of P. **populeus** Kaltenbach, which see.

lophospermum, Macrosiphum Theobald, 1914. Bul. Ent. Research, IV, p. 314, fig.
Lophospermum erubescens.

loti, Aphis Kaltenbach, 1874. Die Pflanzenläuse Aphiden, p. 131.
Lotus corniculatus.

loti, Macrosiphum Theobald, 1912. The Trans. Second Ent. Congres, p. 384; also 1913 Jour. Econ. Biol., VIII, No. 3, p. 139.
Lotus corniculatus.

lucifuga, Tetraneura Zehntner, 1897. Archief Java Suiker Ind., V, p. 555.
Saccharum officinarum.

ludovicianae, Macrosiphum (Oestlund), 1886. Aphididae of Minnesota, p. 23. Siphonophora.
Artemisia ludoviciana A. vulgaris.

lugentis, Aphis Williams, 1911. Aphididae of Nezraska, p. 46.
Senecio lugens.

lusitanica, Schizoneura Horvath, 1908. Broteria, VII, p. 132.
Quercus robur.

lutea, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 119, fig. Siphonophora.
Cypripedium sp., Orchidaceae in hot-houses.

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luteola, Macrosiphum (Williams), 1911. Aphididae of Nebraska, p. 82. Siphonophora.
Solidago missouriensis.

lutescens, Aphis Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, No. 1, p. 23.
Apocynum cannabium, Asclepias incarnata, A. mexicana, A. syriaca, Nerium oleander.

luzulae, Aphis Kaltenbach, 1874. Die Pflanzenläuse Aphiden, p. 725.
Luzula albida.

lychnidis, Myzus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 451. Aphis.
Cucubalus sp., Lychnis alba, L. dioica, L. divaricata, L. viscaria, Melandrum sylvestris, Silene cucubalus, S. italica, S. latifolia.

lycopersicella, Macrosiphum Theobald, 1914. Bul. Ent. Research IV, p. 315, fig.
Brassica sp., Lycopersicum escuentum.

lycopersici, Macrosiphum (Clarke), 1903. Can. Ent., XXXV, p. 253. Nectarophora.
Lycopersicum esculentum.

lycopsidis, Aphis Walker, 1848. The Zool. VI, p. 2218.
Lycopsis arvensis.

lyratus, Chaitophorus Ferrari, as a var. of C. **leucomelas** Koch, which see.

lyropictus, Chaitophorus Kessler, 1886. Nova Acta, Deutschen Akad. Naturf, LI, p. 171.
Acer campestre, A. platanoides.

lythri, Myzus (Schrank), 1801. Fauna Boica II, p. 115. Aphis.
Lythrum salicaria.

macchiatii, Eulachnus Del Guercio, 1909. Redia, V, p. 321, fig.
Abies pectinata, Picea abies, Pinus pinea.

macrocephalus, Lachnus Buckton, 1881. Mon. Brit. Aphides, III, *Picea abies.*
p. 48, fig.

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macrorhyncha, Stomaphis Cholodkovsky, 1894. Bul. Soc. Imp. Nat., Mos., VIII, p. 402, fig.
Quercus sp.

macrosiphum, Illinois Wilson, 1912. Can. Ent. XLIV, p. 155.
Amelanchier sp.

macrostachyae, Symdobius Essig, 1912. Pom. Coll. Jour. Ent. 4, p. 727, fig.
Salix longifolia.

mactata, Aphis Walker, 1849. The Zool. VII, p. 39, app.
Pyrus germanica.

maculata, Callipterus (Heyden), 1837. Ent. Beitr. Museum Senkenberg, II, p. 297. **Aphis.**
Alnus glutinosa.

maculatae, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 61.
Cornus paniculata.

maculatus, Chaitophorus Buckton, 1899. Ind. Mus. Notes, IV, p. 277, fig.
Medicago sativa.

maculatus, Lachnus Lichtenstein, 1884. La Flore des Aphidens, p. 46.
No description.
Rosa sp.

maculella, Monellia (Fitch), 1855. First Rept. Nox. & Ben. Insects, N. Y., p. 166. **Aphis.**
Carya sp.

maculosus, Lachnus Cholodkovsky, 1899. Zool. Anz., XXII, p. 469, fig.
Larix decidua, L. sibirica, Pinus sylvestris.

magnifica, Trinacriella Del Guercio, 1913. Redia, IX, p. 169, fig.
Avena sp.

magnoliae, Aphis Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 254.
Magnolia grandiflora.

mahaleb, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 113, fig.
Prunus chamaecerasus, P. mahaleb.

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maidi-radicis, Aphis Forbes, 1891. Seventeenth Report. Nox. & Ins. Illinois, p. 64, fig.

Amaranthus hybridus, A. retroflexus, A. spinosus, Ambrosia artemisifolia, A. trifida, Anthemis cotula, Brassica juncea, B. nigra, Callistephus hortensis, Capsella bursa-pastoris, Chenopodium album, Chrysanthemum leucanthemum, Cucumis melo, Cucurbita, maxima, C. pepo, Digitaria sanguinalis, Dioidea teres, Echinochloa glauca, Erigeron canadensis, Gnaphalium purpurem, Helianthemum tenuifolium, Helianthus annuus, Krigia virginica, Lepidium incisum, L. vulgare, Leptochloa filiformis, Linaria canadensis, Oxalis stricta, Panicum sp., Plantago aristata, P. major, P. rugelli, Polygonum hydropiperoides, P. incarnatum, P. lapathifolium, P. muhlenbergii, P. persicaria, Portulaca oleracea, Rumex altissimus, R. crispus, Senecio tomentosus, Setaria glauca, S. italica, S. veridis, Sorghum dora, S. halepense, S. saccharatum, Triticum vulgare, Xanthium canadense, Zea mays.

maidis, Aphis Fitch, 1856. Second Rept. Nox. & Ben. Insects N. Y., p. 318.

Ambrosia trifida, Andropogon sp., Digitaria sanguinalis, Echinochloa crus-galli, Hordeum vulgare, Oxalis sp., Panicum dichotomiflorum, Polygonum pennsylvanicum, P. persicaria, Rumex altissium, Saccharum officinarum, Setaria glauca, S. viridis, Sorghum dora, S. halepense, S. saccharatum, Zea mays.

mali, Aphis Fabricius, 1775. Systema Entomologiae p. 737.

Pyrus malus.

mali, Eriosoma Samoulle, 1819. Entom. useful Comp., p. 232. "New name for **Aphis lanigera** of authors."

mali, Myzus Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 221.

Pyrus malus.

malifoliae, Aphis Fitch, 1855. First Rept. Nox. & Ben. Insects N. Y., p. 49.

Pyrus malus.

malvae, Aphis Walker, 1849. The Zool. VII, p. 47, app.

Althaea officinalis, Aquillegia vulgaris, Calacosia antiquorum, Cuphea ignea, Hibiscus sp., Malva rotundifolia M. sylvestris, Quercus sp., Rumex altissimus.

malvae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 125, fig.

Althaea sp., Gossypium herbaceum, Lavatera arborea, Malopa trimestri, Malva parviflora, M. rotundifolia, M. sylvestris.

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malvae, Macrosiphum (Mosley), Gardners Chronicle, I, p. 684. Aphis.
Calla sp., Malva sp.

malvae, Myzus Oestlund, 1886. Aphididae of Minnesota, p. 31.
Malva rotundifolia.

marginata, Forda Koch, 1857. Die Pflanzenläuse Aphiden, p. 311, fig.
Grass.

marginella, Monellia (Fitch), 1855. First Rept. Nox. & Ben. Insects N. Y., p. 166. Aphis.
Carya sp.

marginipennis, Aphis Haldeman, 1844. Proc. Bost. Soc. Nat. Hist., I, p. 168.
Pinus echinata.

marsupialis, Pachypappa Koch, 1857. Die Pflanzenläuse Aphiden, p. 270, fig.
Populus alba, P. nigra, P. pyramidalis.

martini, Macrosiphum (Cockerell), 1903. Can. Ent., XXXV, p. 169. Nectarophora.
Eriogonum ligusticum, Frasera speciosa, Helenium hoopesii, Ligusticum sp., Potentilla hippiana, Rudbeckia hirta, Zygadenus nuttallii.

marutae, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 40.
Anthemis cotula.

matricariae, Myzus Macchiati, 1882. Bul. Ent. Soc. Ital., XIV, p. 245.
Matricaria chamomille.

maydis, Sipha Passerini, 1860. Gli Afidi, p. 38.
Avena sativa, Holcus mollis, Hordeum murinum, H. vulgare, Lilium multiflorum, L. perenne, L. temuelntum, Sorghum halepensis, S. saccharatum, Triticum spelta, Zea mays.

maydis Sipha var. **avenae**, Del Guercio, 1905. Redia, II, p. 144, fig.
Hordeum murinum.

***mayeri, Aphis** Gmeln, 1788. Syst. Nat. 1, part 4, p. 2211.

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medicaginis, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 94, fig.
Astragulus bisculcatus, Caragana arborescens, Coronilla varia, Dolichos sp., Glycyrrhiza lepidota, Gossypium herbaceum, Hibiscus sp., "locust," Medicago denticulata, M. falcata, M. hispida, M. lupulina, M. sativa, Melilotus alba, M. officinalis, Oxytropis lambertii, Robinea viscosa, Spartium junceum, Sphaeralcea pendleri, Trifolium ochroleucum, T. repens, Vicia narbonensis.

melampyri, Anuraphis Del Guercio, 1911. Redia, VII, p. 309, fig.
Melampyrum sp.

melampyrum-latifolium, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 361.
Melampyrum pratense.

melanocephalus, Hyalopterus Buckton, 1879. Mon. Brit. Aphides, II, p. 116, fig.
Silene cucubalus, S. latifolia.

melissae, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1037.
No food plant given.

menthae, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1045.
Mentha aquatica, M. arvensis, M. hirsuta.

menthae, Kaltenbachiella Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 195.
Mentha arvensis, M. sylvestris.

menthae, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 120, fig. Siphonophora.
Cytisus scoparius, Mentha arvensis, M. spicata, M. sylvestris, M. viridis.

menthae, Rhyzobius Passerini, 1860. Gli Afidi, p. 39.
Mentha arvensis.

menthae-radicis, Aphis Cowen, 1895. Hemiptera of Colorado, p. 121.
Mentha arvensis.

mentzeliae, Macrosiphum Wilson, 1915. Trans. Amer. Ent. Soc., XLI, p. 99, fig.
Mentzelia sp.

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mespili, Ovatus Van Der Goot, 1912. Tijdschr. voor Ent. deel LV, p. 64, fig.
Crataegus oxyacantha, Pyrus germanica.

michaelseni, Myzus Schouteden, 1904. Erg. Hamb. Magalh. Sammelr. (2), Sieb. Lief., 7, p. 3.
Acaena splendens.

middletonii, Aphis Thomas, 1879. Eighth Rept. State Ent. Ill., p. 99.
Aster ericoides, A. subulatus, Beta vulgaris, Cosmos bipinnatus, Endive sp., Erigeron canadensis, E. ramosus, Orobanche sp., Solidago canadensis, S. serotina, Vernonia fasciculata.

millefolii, Macrosiphum DeGeer, 1773. Mems des. Inst. III, p. 60. **Aphis.**
Achillea ageratum, A. millefolium, A. ligustica, A. ptarmica, Anthemis tinctoria, Chrysanthemum leucanthemum.

mimosae, Aphis (?) Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 227.
Mimosa sp.

mimuli, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 57.
Mimulus glabratus, M. ringens.

mingazzinii, Eulachnus Del Guercio, 1909. Redia, V, p. 326, fig.
Pinus sylvestris.

minimum, Phylloxera (Shimer), 1869. Trans. Amer. Ent. Soc., II, p. 391. **Dactylosphaera.**
Carya cordiformis.

minimus, Pterocallis Van Der Goot, 1912. Tijdschr. voor Ent., LV, p. 83, fig.
Betula alba.

minor, Macrosiphum (Forbes), 1884. Thirteenth Rept. State Ent. Ill. p. 101. **Aphis.**
Duchesnea indica, Fragaria sp.

minor, Pemphigus Derbes, 1869. Ann. Sci. Nat. ser. (5), XI, p. 106, fig.
Pistacia terebinthus.

minor, Pterochlorus (Del Guercio), 1909. Redia, V, p. 267, fig. **Dryaphis.**
Quercus robur, Q. suber.

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minuta, Aphis Wilson, 1911. Can. Ent. XLIII, p. 60.
Dioscorea bulbifera? Ipomoea sp.

minutum, Trichosiphum Van Der Goot, 1916. Records, Indian Museum XII, p. 2.
Jungle creeper.

minutus, Drepanaphis? Davis, 1910. Ent. News, XXI, p. 195, fig.
Acer saccharum.

mollaginis, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 88, fig.
Galium mollugo.

moltshanovi, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 183.
Food plant?

monardae, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 58.
Monarda fistulosa, M. punctata.

monardae, Phorodon Williams, 1911. Aphididae of Nebraska, p. 89.
Monarda fistulosa.

monelli, Micrella Essig, 1912. Pom. Coll. Jour. Ent. 4, p. 717, fig.
Salix laevigata, S. lasiolepis.

monelli, Drepanaphis Davis, 1909. Ann. Ent. Soc. Amer. II, p. 197. **Phymatosiphum.**
Aesculus glabra.

montanus, Chermes Gillette, 1907. Proc. Acad. Nat. Sci. Phil., p. 14, fig.
Picea pungens.

montemartinii, Chaitophorus Del Guercio, 1913. Redia, IX, p. 179, fig.
Lamium purpureum.

monticellii, Stenaphis Del Guercio, 1913. Redia, IX, p. 185.
Arundo donax, Phragmites communis.

morae, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V, p. 153.
Morus sp., Yerva mora.

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mordwilkiana, Aphis Dobrowljansky, 1913. Kiev. Ent. Sta. South-Russian Agr. Syndicate, p. 34, fig.
Rubus sp.

mordwilkoi, Pemphigus Cholodkovsky, 1912. (1913) Revue Russ. Ent., XII, p. 498, fig.
Populus ciliata.

mori, Aphis Clarke, 1903. Can. Ent. XXXV, p. 251.
Morus sp.

mucidus, Euceraphis (Fitch), 1856. Third Rept. Nox. Ben. Insects, N. Y. p. 334. Callipterus.
Pyrus malus.

muhlenbergiae, Toxoptera Davis, 1912. U. S. Bur. Ent., Tec. ser. Bul. 25, part 1, fig.
Muhlenbergia, racemosa.

muralis, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 157, fig. Siphonophora.
Lactuca muralis.

musae, Aphis Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 223.
Musa ensete.

myopori, Aphis Macchiati, 1882. Bul. Soc. Ent. Ital., XIV, p. 247.
Myoporum pictum.

myosotidis, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 57, fig.
Chrysanthemum sp., Epilobium sp., Erechtites sp., Erigeron canadensis, Eupatorium moriaii, Lepidium draba, L. sativum, Myosotis palustris, M. weltwitschii, Plantago major, Rhinanthus major, Senecio crassifolius, S. longifolius, S. vulgaris.

myricae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 96.
Myrica gale.

myrmecaria, (Forda) ?, Boisduval, 1867. Essai sur Entom. Hort., p. 278. Aphis.
"Cactus," Cuphea sp., Fuschia sp., Latana sp.

myrmecophilum, Macrosiphum Theobald, 1916. XLIX, The Entomologist, p. 49, fig.
Nest of Lasius flavus.

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nabali, Rhopalosiphum Oestlund, 1886. Aphididae of Minnesota, p. 34.
Prenanthes alba.

nainitalensis, Pemphigus Cholodkovsky, 1912. Revue Russ. Ent. XII, p. 94, fig.
Populus ciliata.

najadum, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 45, fig.
Potamogeton natans.

napaeus, Pemphigus Buckton, 1896. Ind. Mus. Notes, IV, p. 50.
Populus sp.

napelli, Aphis Schrank, 1801. Fauna Boica, II, p. 118.
Aconitum napellus, A. uncinatum.

nassonowi, Chaitophorus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 40.
Populus nigra, P. pyramidalis.

nasturtii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 76.
Nasturtium amphibium, N. autsriacum, Periploca graeca, Radicula nasturtium-aquaticum, R. sylvestris, Sisymbrium officinale, Stellaria aquatica.

nasturtii, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, Siphonophora. p. 200, fig.
Nasturtium austriacum, Radicula nasturtium-aquaticum, R. sylvestris, Stellaria aquatica.

navozovi, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 196.
Umbelliferae.

neavei, Macrosiphum Theobald, 1915. Bul. Ent. Research, IV, p. 316, fig.
Food plant unknown.

negundinis, Chaitophorus Thomas, 1877, Ill. State Lab. Nat. Hist. Bul. 2, p. 10.
Acer negundo, Catalpa sp.

neilliae, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 59.
Physocarpus opulifolius.

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mordwilkiana, Aphis Dobrowljansky, 1913. Kiev. Ent. Sta. South-Russian Agr. Syndicate, p. 34, fig.
Rubus sp.

mordwilkoi, Pemphigus Cholodkovsky, 1912. (1913) Revue Russ. Ent., XII, p. 498, fig.
Populus ciliata.

mori, Aphis Clarke, 1903. Can. Ent. XXXV, p. 251.
Morus sp.

mucidus, Euceraphis (Fitch), 1856. Third Rept. Nox. Ben. Insects, N. Y. p. 334. Callipterus.
Pyrus malus.

muhlenbergiae, Toxoptera Davis, 1912. U. S. Bur. Ent., Tec. ser. Bul. 25, part 1, fig.
Muhlenbergia, racemosa.

muralis, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 157, fig. Siphonophora.
Lactuca muralis.

musae, Aphis Schouteden, 1906. Mems. Soc. Ent. Belg., XII, p. 223.
Musa ensete.

myopori, Aphis Macchiati, 1882. Bul. Soc. Ent. Ital., XIV, p. 247.
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myrmecophilum, Macrosiphum Theobald, 1916. XLIX. mologist, p. 49, fig.
Nest of **Lasius flavus.**

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nabali, Rhopalosiphum Oestlund, 1886. Aphididae of Minnesota, p. 34.
Prenanthes alba.

nainitalensis, Pemphigus Cholodkovsky, 1912. Revue Russ. Ent. XII, p. 94, fig.
Populus ciliata.

najadum, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 45, fig.
Potamogeton natans.

napaeus, Pemphigus Buckton, 1896. Ind. Mus. Notes, IV, p. 50.
Populus sp.

napelli, Aphis Schrank, 1801. Fauna Boica, II, p. 118.
Aconitum napellus, A. uncinatum.

nassonowi, Chaitophorus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 40.
Populus nigra, P. pyramidalis.

nasturtii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 76.
Nasturtium amphibium, N. autsriacum, Periploca graesa, Radicula nasturtium-aquaticum, R. sylvestris, Sisymbrium officinale, Stellaria aquatica.

nasturtii, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, **Siphonophora.** p. 200, fig.
Nasturtium austriacum, Radicula nasturtium-aquaticum, R. sylvestris, Stellaria aquatica.

navozovi, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 196.
Umbelliferae.

neavei, Macrosiphum Theobald, 1915. Bul. Ent. Research, IV, p. 316, fig.
Food plant unk[illegible]

negundinis, Chai[illegible] omas [illegible] tate Lab. Nat. Hist. Bul. [illegible]
Acer negu[illegible]

[illegible]ae, A[illegible], 18[illegible] [illegible]ota, p. 59.
[illegible]

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nekoashii, Astegopteryx Sasaki, 1907. Tokyo Nap. Konch. Kev. No. 1, p. 25, pl. Also Mems. Cong. Int. Ent., 1910, p. 450, fig.
Styrax japonicum.

neomexicanus, Myzus Cockerell, 1901. Can. Ent. XXXIII, p. 227.
Ribes lepanthum.

nepetae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 77.
Nepeta cataria, Origanum vulgare, Satureja nepeta, S. vulgaris.

nephrolepidis, Idiopterus Davis, 1909. Ann. Ent. Soc. Amer. II, p. 199.
Acrostichum reticulatum, "Filicales," Nephrolepis exaltata.

neriastri, Aphis Boisduval, 1867. Essai sur L'Entomalogie Horticole, p. 226. A new name for **Aphis nerii** Boyer.

nerii, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 118.
Acanthaceae sp., Anagallis arvensis, A. linifolia, A. tenella, Catalpa bignonoides, "Cymonandra," Cyphomandra betacea, Durania illisia, Hydrangea hortensia, Lupinus moritzianus, Nerium oleander, Solanum nigrum, Tecoma radicans.

nerii, Cryptosiphum Perez, 1901. Nuov. Giorn. Bot. Ital., VIII, n. s. p. 442.
Nerium oleander.

nerii, Myzus (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France X, p. 179. **Aphis.**
Asclepias syrica, Nerium oleander.

nervatum, Rhopalosiphum Gillette, 1908. Can. Ent. XL, p. 63, fig.
Rosa sp.

nervosa, Aphis Zetterstedt, 1840. Insecta Lapponica, p. 311.
Species not recognizable.

nidificus, Prociphilus Low, 1882. Wien. Ent. Zeit., I, p. 14.
Abies sp., Fraxinus excelsior.

niger, Phyllaphis Ashmead, 1881. Can. Ent. XIII, p. 155.
Quercus phellos.

nigra, Pergandeida Wilson, 1911. Can. Ent., XLIII, p. 62.
Cyrilla racemiflora.

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nigra, Aphis (Myzus), Theobald, 1916. Can. Ent., XLVIII, p. 233.
A new name for **Aphis oxyacanthae** Koch not Schrank.
Pyrus malus.

nigra, Pterochlorus Del Guercio, as a var. of **P. roborus** Linnaeus, which see.

nigrae, Chaitophorus Oestlund, 1886. Aphididae of Minnesota, p. 49.
Salix longifolia, S. nigra.

nigrinectaria, Macrosiphum Theobald, 1915. Bul. Ent. Research VI, p. 107, fig.
Pisum arvense.

nigripes, Aphis Theobald, 1914. Bul. Ent. Research, IV, p. 327, fig.
Salix sp.

nigritarsis, Aphis Heyden, 1837. Ent. Beitr. Mus. Senk., II, p. 299.
II, p. 299.
Betula alba, Caltha palustris.

nigrofasciatus, Eulachnus Del Guercio, 1909. Redia, V, p. 324, fig.
Pinus sylvestris.

nigronervosa, Pentalonia Coquerel, 1859. Ann. Ent. Soc. Fr. VII, ser. 3, p. 259.
Musa sapientium.

nigro-rufa, Aphis Walker, 1848. The Zool. VI, p. 2247.
Anagallis arvensis.

nigrotuberculata, Lachniella Del Guercio, 1909. Redia, V, p. 306, fig.
Larix decidua, L. leptolassa.

nociva, Aphis Walker, 1849. The Zool. VII, p. 36, app.
Prunus spinosa.

nordmannianae, Chermes Eckstein, 1890. Zool. Anz., XII, p. 90.
Tsuga canadensis.

norvegicum, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 143.
Food plant?

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notabilis, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 235.
Carya illinoensis.

noxius, Brachycolus Mordwilko.
The original citation was not located but this name is now commonly used in Russian publications.
See Review of Applied Entomology, 1916 (London).

nüsslini, Dreyfusia Börner, 1908. Zool. Anz., XXXIII, p. 739.
(This name applied to a species which Börner thinks has been misnamed by several authors as follows:
Chermes funitectus Cholod. 1907, nec. Dreyfus, 1888.
" **nordmannianae** Eckstein, 1890.
" **obtectus** Ratzeburg, a. p. 1844.
" **piceae** Nusslin, a. p. 1903, 1905, 1908.
" **piceae** Börner, a. p. 1908.)
Abies nobilis, A. nordmanniana, A. pectinata, Picea sp.

nutricata, Aphis Walker, 1849. The Zool. VII, p. 39, app.
Pyrus germanica.

nymphaeae, Siphocoryne (Linnaeus), 1761. Fauna Suecica, revised and enlarged edition of the 1746 edition, p. 260. **Aphis.**
Acorus calamus, Alisma plantago, Ammannia sp., Arum italicum, Bidens frondosa, Butomus umbellatus, Calla sp., Callitriche autumnaeis., Cicuta virosa, Cypripedium sp., Elodea canadensis, Hydrocharis morsus-ranea, Hydrocotyle vulgaris, Juncus lampocarpus, Lemna gibba, L. minor, L. polyrhiza, L. trisulca, Limnanthemum nymphoides, Marsilea quadrifolia, Menyanthes trifoliata, Myriophyllum verticillatum, Najas flexilis, Nelumbium lutea, Nuphar sp., Nymphaea alba, N. lutea, N. odorata, Nymphoides peltatum, Polygonum sp., Pontedaria cordata, Potamogeton crispus, P. natans, P. pectinatus, Prunus domestica, Ranunculus acris, R. aquatilis, R. fluitans, R. sceleratus, Richardea africana, Sagittaria sagittifolia, Salvinia natans, Saururus cernus, Sparganium ramosum, Spirodela polyrrhiza, Trapa sp., Typha angustifolia, T. latifolia, Utricularia vulgaris.

nyssae, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 269.
Nyssa sylvatica.

obliqua, Schizoneura Cholodkovsky, 1896. Zool. Anz., XIX, p. 259.
Abies balsamea, A. concolor, Picea alba, P. canadensis, Tsuga canadensis.

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oblonga, Lachniella Del Guercio, 1909. Redia, V, p. 289, fig.
Pinus silvestris.

oblongum, Macrosiphum (Mordwilko), 1901. Horae Soc. Ent. Ross., XXXIII, p. 343. Siphonophora.
Artemisia vulgaris.

oblongus, Smydobius (Heyden), 1837. Ent. Beitr. Muse. Senk., II, p. 298. Aphis.
Betula alba.

obnoxia, Aphis Mordwilko, 1916. (Rept. Ent. Bur. Stavropol 1914) Published by Dept. Agr. of Min. of Agr. Petrograd. (Rev. Applied Ent. IV, Ser. A, part 11, p. 459).

obscura, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 167, fig. Siphonophora.
Hieracium prealtum.

obscura, Schizoneura Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1051.
No food plant given.

obtectus, Chermes Ratzeburg, 1844. Die Forst-Insecten, p. 200, foot note.
Pinus sp.

occidentalis, Forda Hart, 1894. Eighteenth Rept., State Ent. Ill., p. 95, fig.
Capsella bursa-pastoris, Poa pratensis, Zea mays.

occidentalis, Lachnus Davidson, 1909. Jour. Econ. Ent., II, p. 300.
Abies grandis.

ochrocentri, Aphis Cockerell, 1903. Ent. News, XIV, p. 248.
Carduus ochrocentrus.

ochropus, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 128, fig.
Chenopodium album, Dipsacus sylvestris, Rumex altissimus.

oenanthis, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 36. No description.
Oenanthe sp.

oenotherae, Anoecia Wilson, 1911. Can. Ent., XLIII, p. 63.
Oenothera sp.

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oenotherae, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 62.
Epilobium sp., Oenothera bertiana, O. biennis, O. caespitosa, O. serrulata.

oenotherae, Myzus Williams, 1911. Aphididae of Nebraska, p. 64.
Oenothera biennis, O. bertiana.

oenotherae, Pemphigus Williams, 1891. Special Bul. No. 1, Univ. Neb. Dept. Ent. p. 27. No description.
Oenothera biennis.

oestlundi, Pemphigus Cockerell, 1906. Ent. News, XVII, p. 34.
A new name for **P. vagabundus** (Walsh) Oestlund.

oleae, Eriosoma, Risso, 1826. Hist. Nat. Prin. l'Europe, merid. V, p. 218.
Olea europea.

olivacea, Forda Rohwer, 1908. Psyche, XV, p. 68.
"Grass roots."

olivata, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 164, fig. **Siphonophora.**
Cirsium alnceolatum.

***onobrychidis, Aphis** Goureau, 1863. Bul. Soc. Sci. Hist. Nat. Yonne, part 2, p. 129.
Hedysalum onobrychis.

onobrychis, Macrosiphum (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 169. **Aphis.**
Onoboychis viciaefolia.

ononidis, Myzocallis (Kaltenbach), 1846. Ent. Zeit. (Stettin) VII, p. 173. **Aphis.**
Medacago sativa, Melilotus alba, Ononis hircina, O. spinosa, Trifolium alexandrinum, T. pratense, T. procumbens.

ononidis, Pergandeida Schouteden, 1903. Zool. Anz., XXVI, p. 686.
Ononis repens.

ononis, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 175, fig. **Siphonophora.**
Ononis rotundifolia, O. spinosa.

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onopordi, Aphis Schrank, 1801. Fauna Boica, II, p. 121.
Carduus nutans, Cirsium lanceolatum, Onopordon illyricum.

opima, Aphis, Buckton, 1879. Mon. Brit. Aphides, II, p. 101, fig.
Doronicum cruenta.

opuli, Aphis Sulzer, 1776. Abgekurz Gesch. Ins. p. 105, fig.
Viburnum opulus.

oreaster, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 17.
Aster paniculata.

oregonensis, Aphis Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 92, fig.
Artemisia tridentata.

oregonensis, Lachnus Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 103, fig.
Pinus sp.

oregonensis, Microsiphum Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 91, fig.
Artemisia tridentata.

orientale, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 141.
Food plant?

orientale, Macrosiphum Van Der Goot, 1912. Tijdschr. voor Ent. deel LV, p. 322.
Blumea balsamifera.

orientalis, Chermes Dreyfus, 1889. Tag. 61 Vers. Deut. Nat., Koln. pt. 2, p. 60.
Picea abies, P. orientalis, Pinus orientalis, P. strobus, P. sylvestris.
(Cholodkovsky (1915) gives this species as a synonym of Chermes pini Koch but indicates that it should be known as one of two varieties of that species.)

origani, Aphis Passerini, 1860. Gli Afidi, p. 36.
Calamintha acinos, Carduus sp., Origanum paniculatum, O. vulgare., Satureja nepeta, S. vulgaris.

orobanches, Aphis Passerini, 1870. Bul. Ent. Soc. Ital., XI, p. 45.
Orobanche lutea, O. muteli, O. ramosa, Lathraea squamaria.

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orobanches, Macrosiphum Lichtenstein, 1884. La Flore des Aphidens, p. 37. No description.
Orobanche sp.

orthocarpus, Macrosiphum Davidson, 1909. Jour. Econ. Ent. II, p. 304.
Orthocarpus sp.

osmaroniae, Illinoia Wilson, 1912. Can. Ent. XLIV, p. 153.
Osmaronia cerasiformis.

ovata-oblongus, Pemphigus Kessler, 1881. Ber. Ver. Naturkunde Kassel, XXVIII, p. 61, fig.
Populus nigra, P. pyramidalis.

oxalis, Aphis Macchiati, 1883. Bul. Ent. Soc. Ital., XV, p. 255.
Oxalis corniculata.

oxybaphi, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 62.
Oxybaphus angustifolius, O. linearis, O. nyctagineus.

oxyacanthae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 55, fig.
Pyrus communis.

oxycanthae, Myzus (Schrank), 1801. Fauna Boica, II, p. 116. Aphis.
Crataegus oxycantha, Prunus chamaecerasus, Pyrus communis, P. malus.

paczoskii, Acyrthosiphon Mordwilko, as a var. of **A. gossypii** Mordwilko, which see.

padi, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 451.
Alopecurus pratensis, Crataegus oxyacantha, Prunus padus, Pyrus aucuparia, P. germanica, P. malus.

padi, Lachnus Hartig, 1841. Zeit. Ent. (Germar), III, p. 368.
Alopecurus pratensis. Prunus padus.

palens, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1043.
Food plant not given.

paliuri, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 37. No description.
Paliruim sp.

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pallida, Hyalopteroides Theobald, 1916. The Entomologist, XLIX, p. 51, fig.
In nest of Lasius niger.

pallida, Macrosiphum (Walker), 1848. Ann. Mag. Nat. Hist., ser. 2, II, p. 430. Aphis.
Malva rotundifolia, M. sylvestris, Pelargonium zonale, Villarisia sp.

pallida, Macrosiphum (Oestlund), 1887. Aphididae of Minnesota, p. 84. Nectarophora.
Rosa sp. (wild)

pallida, Tetraneura (Haliday), 1839. Ann. Nat. Hist. Mag., II, p. 189. Byrsocrypta.
Pistacia terebinthus, Ulmus campestris, U. tuberosa.

pallidula, Tychea Cockerell, 1903. Psyche, X, p. 217.
Food plant not given.

pallidus, Pemphigus Derbes, 1869. Ann. Sci. Nat. Zool. (5), XI, p. 105, fig.
Pistacia terebinthus.

pallipes, Aphis Hartig, 1841. Zeit. Ent. (Germar) III, p. 369.
Fagus sp.

panici, Tychea (Schizoneura)? Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 16.
Digitaria humifusa, Setaria glauca.

panicola, Macrosiphum Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 6. Siphonophora.
Digitaria humifusa, Echinochloa crus-galli, Eragrostis pectinacea.
Thomas gives this name for what he calls *Siphonophora setariae on Panicum* should it prove to be different from the one on *Setaria.*

panicola, Schizoneura Thomas, 1879. Eighth Rept. Ben. & Nox. Insects, Ill., p. 138.
Digitaria humifusa, Echinochloa crus-galli, Poa pratensis, Polygonum sp., Setaria glauca, S. viridis.

paoli, Aphis Del Guercio, 1916. Redia, XI, p. 301, fig.
Calotropis procera.

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papaveris, Aphis Fabricius, 1776. Genera Insectorum, II, p. 388.
Aegopodium podagraria, Amaranthus retroflexus, Aristolochia clematitis, Atriplex hastata, A. hortensis, A. nitens, A. patula, Beta vulgaris, Bougainvillaea virescens, Cannabis sativa, Capsella bursa-pastoris, Chenopodium album, C. botrys, Cirsium arvense, Cucumis sativus, Cucurbita pepo, Eryngium campestre, E. planum, Fumaria sp., Galium aparine, Hypericum hirsutum, H. perforatum, Matricaria chamomilla, M. inodora, Ophrys aranifera, Orchis coriophora, Papaver dubium, P. nudicaule, P. rhoeas, P. somniferum, Phaseolus vulgaris, Ranunculus acris, Scorzonera hirsuta, Senecio vulgaris, Setaria verticillata, S. viridis, Solanum nigrum, S. tuberosum, Vicia faba, Zea mays.

papyraceae, Hormaphis Oestlund, 1887. Aphididae of Minnesota, p. 19.
Betula alba, papyracea.

parietariae, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 38, no description.
Parietaria sp.

parthenocissi, Aphis Williams, 1911. Aphididae of Nebraska, p. 53.
Psedera quinquefolia.

particeps, Aphis Walker, 1848. The Zool. VI, p. 2217.
Cynoglossum officinale.

parvus, Aphis Theobald, 1915. Bul. Ent. Research VI, p. 127, fig.
Chrysanthemum sp.

parvus, Lachnus Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 104, fig.
Pinus rigida, P. virginiana.

pasaniae, Myzocallis Davidson, 1915. Jour. Econ. Ent. VIII, p. 424.
Pasania densiflora.

pasaniae, Trichosiphum Okajima, 1908. Bul. Coll. Agr. Tokyo Imp. Univ., VIII, No. 1, p. 23 of separate.
Quercus acuta, Q. cuspidata, Q. serrata.

passeriniana, Cerosipha Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir., II, p. 117.
Salvia splendens.

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passerinii, Schizoneura Signoret, 1875. Bul. Soc. Ent. France (5), V, p. CCII.
Populus alba.

pastinaceae, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 41, fig.
Lonicera sp., Pastinaca sativa.

pastinaceae, Siphocoryne (Linnaeus), 1758. Edition 10, Systema Naturae, p. 451. Aphis.
Cicuta virosa, Conium maculatum, Daucus carota, Foeniculum vulgare, Heracleum lanatum, Pastinaca sativa, Pimpinella magna, P. saxifraga, Salix aurita, S. babylonica, Sisymbrium officinale, Zizia aurea.

patchii, Thecabius Gillette, 1914. Ann. Ent. Soc. Amer. VII, p. 61.
Populus balsamifera.

pawlowae, Pentaphis Mordwilko, 1901. Horae Soc. Ent. Ross., XXXIII, p. 83.
Bromus hordeaceous.

pectinatae, Chermes Cholodkovsky, 1888. Zool. Anz., XI, p. 47.
Abies balsamea, A. pectinata, A. sibirica, Picea abies.

pedicularis, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 41, fig.
Pedicularis palustris.

pedunculi, Pemphigus Hartig, 1841. Zeit. Ent. (Germar), III, p. 367.
Quercus sp.

peglandicola, Chromaphis Walker, 1870. The Zool. p. 2001, new name for **Callipterus juglandicola** Kaltenbach.

pelargonii, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 21. Aphis.
Althaea rosea, Chrysanthemum sp., Geranium robertianum, Hydrangea sp., Justica furcata, Lilium sp., Malva neglecta, M. sylvestris, Pelargonium zonale, Pyrus germanica.

pellucida, Endeis Buckton, 1883. Mon. Brit. Aphides, IV, p. 91, fig.
Poa annua.

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pemphigöides, Phylloxera Donnadieu, 1887. Compt. Rend. Acad. Sci. Paris, CIV, p. 1246.
Vitis vinifera.

penicillata, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 51, fig.
Epilobium hirsutum, E. montanum.

pentstemonis, Aphis Williams, 1911. Aphididae of Nebraska, p. 54.
Musenum tenuifolium, Pentstemon glaber.

perforans, Phylloxera Pergande, as a var. of **P. caryae-septum** Shimer, which see.

perforatus, Aphis Signoret, 1867. Ann. Ent. Soc. France, (4), VII, p. 379.
Acer campestre.

perniciosa, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 251.
Carya alba.

persequens, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1044.
Tanacetum sp.

persicae, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 175.
Petasites officinalis, Prunus amygdalus, P. domestica, P. insititia, P. persica, P. spinosa.

persicae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 93.
Prunus persica.

persicae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 61, fig.
Prunus persica.

persicae, Lachnus Cholodkovsky, 1899. Zool. Anz., XXII, p. 472, fig.
Prunus amygdalus.

persicae, Myzus Passerini, 1860. Gli Afidi, p. 35.
Prunus persica.

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persicae, Rhopalosiphum Sulzer, 1776. Abgekurz Gesch. Ins. p. 105, fig. **Aphis.**

Acer negundo, Achryantes sp., Alternanthera sp., Althaea narborensis, A. officinalis, A. rosea, Amaranthus sp., Ammannia sp., Anthemis cotula, Antirrhinum majus, Aquilegia vulgaris, Asparagus officinalis, Atropa belladona, Barbarea vulgaris, Bellis perennis, B. sylvestris, Beta vulgaris, Brassica alba, B. arvensis, B. campestris, B. napus, B. oleracea, B. rapa, Cakile maritima, Calendula arvensis, Caltha palustris, Canna indica, Capsella bursa-pastoris Capsicum annuum, Chaerophyllum aromaticum, C. hirsutum, C. roseum, Chenopodium album, C. bonushenricus, Chrysanthemum balsamita, C. coccineum, Cineraria sp., Citrullus vulgaris, Cochlearia armoracia, Colocasia antiquorum, Convolvulus sp., Crepis tectorum, Crocus sp., Cucumis melo, Cyrtanthus sp., Dianthus caryophyllus, Digitalis purpurea, Dysodia sp., Erodium botrys, E. cicutarium, Euphorbia maculata, E. marginata, E. peplus, Fuchsia cocinea, F. globosa, F. micrantha, Fumaria officinalis, Galactites tomentosa, Galium mollugo, Geranium molle, G. robertianum, Gladiolus dubius, Gossypium herbaceum, Hedera helix, Heliotropium peruvianum, Hibiscus sp., Hordeum vulgare, Hyacinthus orientalis, Inula dysenterica, Ionidum concolor, Iresine lindeni, Iris pumila, Lactuca spicata, Lepidium sativum, Lilium candidum, Lupinus sp., Lycopersicum esculentum, Malva parviflora, M. rotundifolia, M, sylvestris, Malvastrum coccineum, Marsilea vestita, Maurandia hendersoni Mentha aquatica, M. piperita, Mesembrianthemum sp., Myosotis scorpioides, Myrtus sp., Narcissus sp., Nerium oleander, Nicotiana rustica, N. tabacum, Nonnea sp., Onopordon acanthium, Opuntia sp., Oxalis corniculata, O. rosea, Papaver rhoeas, Pimelea sp., Plantago lanceolata, Poa sp., Polyanthus tuberosa, Polygonum persicaria, Portulaca sp., Potentilla recta, Primula forbesi, P. vulgaris, Prunus americana, P. amygdalus, P. armeniaca, P. cerasus, P. domestica, P. melanocarpa, P. persica, P. serotina, P. spinosa, Pyrus communis, P. malus, Radicula armoracia, R. nasturtium-aquaticum, Ranunculus acris, R. bulbosus, R. repens, R. sardous, Raphanus raphanistrum, R. sativus, Rapistrum rugosum, Richardia africana, Ricinus communis, Robinia pseudoacacia, Rudbeckia sp., Rumex acctosa, R. altissimus, R. conglomeratus, R. crispus, R. hydrolapthum, R. venosus, Salix sp., Salsola kali, Semele androgyne, Senecio crassifolius, S. jacobaea, S. vulgaris, Sisymbrium alliaria, S. austriacum, Solanum dulcamara, S. melongena, S. nigrum, S. tuberosum, Sonchus oleraceus, Spergula arvensis, Spinacia oleracea, Stellaria media, Syringa vulgaris, Taraxacum officinale, Thalictrum minus, Townsendia sericea, Trifolium pratense, T. repens, Triticum sativum, T. vulgare, Tropaeolum majus, T. tricolorum, Tulipa gesneriana, Tunica

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prolifera, Typha angustifolia, T. latifolia, T. shuttleworthii, Verbena chamaedryfolia, Viburnum opulus, Vicia pseudo-cracca, Vinca sp., Viola odorata, V. tricolor, Zea mays.

persicae-niger, Aphis Smith, 1890. Ent. Amer. VI, p. 101.
Prunus chicasa, (wild goose plum), *Prunus persica.*

persicaecola, Aphis Boisduval, 1867. Essai sar Entom. Hort., p. 251.
Prunus persica.

persicariae, Aphis Hartig, 1841. Zeit. Ent. (Germar) III, p. 370.
Prunus armeniaca, P. domestica, P. perisca.

persicarum, Aphis Boisduval, 1867. Essai sur Entom. Hort., p. 252.
Prunus persica.

persicophila, Aphis Passerini, 1860. Gli Afidi, p. 36.
Prunus persica.

persola, Aphis Walker, 1848. The Zool. VI, p. 2246.
Anagallis arvensis, Chrysanthemum segetum.

persorbens, Aphis Walker, 1849. The Zool. VII, p. 37, app.
Prunus domestica.

petasitidis, Aphis Buckton, 1879. Mon. Brit. Aphides, II, p. 69, fig.
Cynoglossum officinalis, Petasites japonicus, P. niveus.

phaseoli, Tychea Passerini, 1860. Gli Afidi, p. 39.
Amaranthus graecizans, A. retroflexus, Brassica oleracea, Euphorbia lathyris, Phaseolus coccineus, P. vulgaris.

pheidolei, Aphis Theobald, 1916. Entomologists Record, XXVIII, p. 37.
In ant's nest, **Pheidole** sp.

phelipaeae, Aphis Passerini, 1879. Bul. Ent. Soc. Ital., XI, p. 47.
Orabanche ramosa.

phenax, Myzus Cockerell, 1903. Trans. Amer. Ent. Soc. XXIX, p. 115.
Humulus lupulus.

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phlomoidea, Aphis Del Guercio, 1911. Redia, VII, p. 323.
Verbascum phlomoides.

phragmitidicola, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 44.
Phragmitis communis.

***phyllophora, Chelymorpha** Clarke, 1858. The Microscope, p. 112.
Acer campestris.

piceae, Chermes Ratzeburg, 1844. Die Forst-Insecten, p. 204.
Abies pectinata, Picea sp.

picea Chermes Ratzeburg, var **bouveri**, Cholodkovsky, 1903. Zool. Anz., XXVI, p. 259.
Abies nobilis var. glauca.

piceae, Lachnus Panzer, 1801. Fauna Insettorum Germanica Iniciae, XXVI, p. 22, fig. **Aphis.**
Picea abies, P. alba.

***piceae, Pemphigus** (Hartig), 1857. Verhandl. d. Hils-Solling-Forstvereins, Jahrg. 1856, pp. 52–57. **Rhizomaria.**
Larix sp., Picea sp., Pinus sp.

picealla, Macrosiphum Theobald, 1916. The Entomologist, XLIX, p. 146.
Picea abies.

piceicola, Lachnus Cholodkovsky, 1896. Zool. Anz. XIX, p. 148.
Picea abies.

piceicola Lachnus var. **viridescens**, Cholodkovsky, 1896. Zool. Anz. XIX, p. 509.
Picea abies.

pichtae, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 104.
Abies pectinata.
For description in German see Zool. Anz. XVIII, p. 103.

picridis, Macrosiphum (Fabricius), 1775. Systema Entomologiae. p. 737. **Aphis.**
Agrostemma githago, Cichorium endivia, C. intybus, Crepis biennis, C. capillaris, C. tectorum, Hieracium, murorum, H. pilosella, H. spondylium, H. sylvaticum, H. sylvestris, H. umbellatum, H. vulgatum, Hypochoeris sp., Juglans regia, Leontodon autumnalis, L. hispida, Picridum vulgare, Picris hieracioides, Taraxacum officinale.

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picta, Aphis Walker, 1849. The Zool. VII, p. 47, app.
Sambucus nigra.

picta, Lachniella Del Guercio, 1909. Redia, V, p. 293, fig.
Pinus sylvestris.

picta, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 197.
Carya alba, C. glabra.

pictus, Pterocallis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 77.
Ambulaero aequasola.

pilicornis, Aphis Hartig, 1841. Zeit. Entom. (Germar) III, p. 369.
Picea abies.

pilosa, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist., I, p. 168.
Salix sp.

pilosa, Aphis Walker, 1849. The Zool. VII, p. 54, app.
Digetalis purpurea.

pilosa, Aphis Zetterstedt, 1840. Insecta Laponica, I, p. 311.
Species not recognizable.

pilosa, Glyphina Buckton, 1883. Mon. Brit. Aphides, IX, p. 16, fig.
Pinus sylvestris.

pilosa, Pterocomma Buckton, 1879. Mon. Brit. Aphides, II, p. 143, fig.
Salix cinerea, S. daphnoides, S. viminalis.

pilosellae, Rhizobius Burmeister, 1835. Hand. der Entomologie, II, p. 87.
Hieracium pilosella, Zea mays.

pilosula, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 203.
Carya glabra.

pilosus, Myzus Van Der Goot, 1912. Tijdschr. voor Ent., LV, p. 68.
Artemisia vulgaris.

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pineoides, Chermes Cholodkovsky, as a var. of C. **pini** Koch, which see.

pimpinellae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 105.
Pimpinella magna, P. saxifraga.

pineti, Lachnus (Fabricius) 1781. Species Insectorum, II, p. 389. **Aphis.**
Pinus "maritima", P. sylvestris.

pineus, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 126.
Pinus "maritima", P. strobus, P. sylvestris.
For description in German see Zool. Anz. 1895, XVIII, p. 100.

pineus, Lachnus var. **curtipilosa,** Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ. p. 130.
Pinus sp.

pini, Chermes (Macquart), 1819. Soc. d'amat. des Sciences et Arts de la villede Lille. Mars. 12. 8., pp. 81–86.
Picca abies, P. orientalis, Pinus montana, P. pinea, P. sylvestris.

pini, Chermes (Koch), 1857. Die Pflanzenläuse Aphiden, p. 322, fig. **Anisophleba.**
Abies sibirica, Pinus insignis, P. "montanum", P. pumilio, P. sylvestris.

pini, Chermes Koch, var. **pineoides,** Cholodkovsky, 1903. Zool. Anz. XXVI, p. 263.
Picea abies, P. orientalis, Pinus sp.

pini, Chermes Koch, var. **pinicola,** Cholodkovsky, 1915. Dept. of Agr., Central Board of Land. Amins. & Agr. Petrograd, p. 57, fig.
Picea excelsa, Pinus montanus, P. sylvestris.

pini, Lachnus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Larix decidua, Pinus cembra, P. halepensis, P. ponderosa, P. scopulorum, P. sylvestris.

pini, Lachnus Linnaeus, var. **cembrae,** Cholodkovsky, 1892. Zool. Anz. XV, p. 74.
Pinus cembra?

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picta, Aphis Walker, 1849. The Zool. VII, p. 47, app.
Sambucus nigra.

picta, Lachniella Del Guercio, 1909. Redia, V, p. 293, fig.
Pinus sylvestris.

picta, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 197.
Carya alba, C. glabra.

pictus, Pterocallis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 77.
Ambulaero aequasola.

pilicornis, Aphis Hartig, 1841. Zeit. Entom. (Germar) III, p. 369.
Picea abies.

pilosa, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist., I, p. 168.
Salix sp.

pilosa, Aphis Walker, 1849. The Zool. VII, p. 54, app.
Digetalis purpurea.

pilosa, Aphis Zetterstedt, 1840. Insecta Laponica, I, p. 311.
Species not recognizable.

pilosa, Glyphina Buckton, 1883. Mon. Brit. Aphides, IX, p. 16, fig.
Pinus sylvestris.

pilosa, Pterocomma Buckton, 1879. Mon. Brit. Aphides, II, p. 143, fig.
Salix cinerea, S. daphnoides, S. viminalis.

pilosellae, Rhizobius Burmeister, 1835. Hand. der Entomologie, II, p. 87.
Hieracium pilosella, Zea mays.

pilosula, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 203.
Carya glabra.

pilosus, Myzus Van Der Goot, 1912. Tijdschr. voor Ent., LV, p. 68.
Artemisia vulgaris.

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pineoides, Chermes Cholodkovsky, as a var. of C. **pini** Koch, which see.

pimpinellae, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 105.
Pimpinella magna, P. saxifraga.

pineti, Lachnus (Fabricius) 1781. Species Insectorum, II, p. 389. **Aphis.**
Pinus "maritima", P. sylvestris.

pineus, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 126.
Pinus "maritima", P. strobus, P. sylvestris.
For description in German see Zool. Anz. 1895, XVIII, p. 100.

pineus, Lachnus var. **curtipilosa,** Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ. p. 130.
Pinus sp.

pini, Chermes (Macquart), 1819. Soc. d'amat. des Sciences et Arts de la villede Lille. Mars. 12. 8., pp. 81–86.
Picca abies, P. orientalis, Pinus montana, P. pinea, P. sylvestris.

pini, Chermes (Koch), 1857. Die Pflanzenläuse Aphiden, p. 322, fig. **Anisophleba.**
Abies sibirica, Pinus insignis, P. "montanum", P. pumilio, P. sylvestris.

pini, Chermes Koch, var. **pineoides,** Cholodkovsky, 1903. Zool. Anz. XXVI, p. 263.
Picea abies, P. orientalis, Pinus sp.

pini, Chermes Koch, var. **pinicola,** Cholodkovsky, 1915. Dept. of Agr., Central Board of Land. Amins. & Agr. Petrograd, p. 57, fig.
Picea excelsa, Pinus montanus, P. sylvestris.

pini, Lachnus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Larix decidua, Pinus cembra, P. halepensis, P. ponderosa, P. scopulorum, P. sylvestris.

pini, Lachnus Linnaeus, var. **cembrae,** Cholodkovsky, 1892. Zool. Anz. XV, p. 74.
Pinus cembra?

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***pini, Macrhynchus** ? 1913. Haup p. 45, Mitt. ent. Ges. Hall 5-7.
Food plant?

pini, Rhizobius Burmeister, 1835. Hand. der Entomologie, II, p. 87.
Pinus sylvestris.

pinicola, Chermes Cholodkovsky, as a var. of C. pini Koch which see.

pinicola, Lachnus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 154.
Larix decidua, Picea abies, Pinus "mughus", P. sylvestris.

pinicola, Mindarus (Thomas), 1879. Eighth Rept. State Ent. Ill.. p. 137. **Schizoneura.**
Pinus insignis, P. ponderosa, P. strobus, Zea mays.

pinicolens, Chaitophorus Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 66.
Pinus sp.

pinicorticis, Chermes (Fitch), 1855. First Rept. Nox. & Ben. Insects N. Y. p. 167. **Coccus.**
Pinus laricio, P. pinaster, P. "pinastu-maritima", P. strobus, Pinus sylvestris.

pinifoliae, Chermes Fitch, 1858. Fourth Rept. Nox. & Ben. Insects N. Y., p. 741.
Picea alba, P. mariana, P. rubra, Pinus strobus.

pinihabitans, Lachnus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 118.
Pinus sylvestris.
For description in German see Zool. Anz. XVIII, 1895, p. 98.

piniphila, Lachnus (Ratzeburg), 1844. Die Forst-Insecten, III, p. 219. **Aphis.**
Pinus sp.

pini-radiatae, Lachnus Davidson, 1909. Jour. Econ. Ent. II, p. 299.
Pinus insignis.

piperis, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V, p. 152.
Piper sp.

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piri, Phylloxera Cholodkovsky, 1903. Zool. Ans., XXVII, p. 118.
Pyrus communis.

***piri, Schizoneura** (Goethe) Mordwilko, 1900. Horae Soc. Ent. Ross. XXXIII, p. 206. **Eriosoma?**
Goethe gives as a variety of **E. lanigera** Hausmann. Mordwilko gives as a good species.
Pyrus communis.

pisi, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 23. **aphis.**
Asperula sp., Beta vulgaris, Capsella bursa-pastoris, Chaerophyllum sylvestris, C. temulum, Colutea arborescens, Cytisus scoparius, Epilobium montanum, Genistia tinctoria, Geum urbanum, Gratiola officinalis, Lactuca scariola, Lathyrus latifolius, L. odoratus, L. pisiformis, L. pratensis, L. sativus, L. sylvestris, Lotus corniculatus, L. uliginosus, Lychnis dioica, Medicago falcata, M. sativa, Melilotus alba, Onobrychis sp., Ononis lurcina, O. repens, Pisum arvense, P. sativum, Spirea ulmaria, Stellaria holostea, Trifolium "filaforme", T. hybridum, T. incarnatum, T. pratense, T. repens, Urtica dioica, Vicia angustifolia, V. gigantea, V. ludoviciana, V. sativa, V. sepium, V. villosa.
For discussion of the food plants of this species see Bulletin 276, U. S. Bur. Ent. p. 9.

pisi Acyrthosiphon Kaltenbach sub. sp. **destructor** (Johnson) Mordwilko, 1914, Fauna of Russia (Insecta Hemiptera), I, Petrograd., p. 136.
See **Macrosiphum destructor** Johnson.
Pisum sp.

pisi Acyrthosiphon Kaltenbach sub. sp. **turanicum** Mordwilko, 1914, Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 139.
Medicago sativa, Trifolium sp.

pisi Acyrthosiphon Kaltenbach, sub. sp. **ussuriensis**, Mordwilko, 1914, Fauna of Russia, (Insects Hemiptera), I, Petrograd., p. 140.
"Lathyro" sp.

pistaciae, Pemphigus (Linnaeus), 1767, Systema Naturae, Twelfth Edition, I, part 2, p. 737, No. 33, **Aphis.**
Pistacia lentiscus, P. terebinthus, P. vera.

plantagineus, Myzus Passerini, 1860, Gli Afidi, p. 35.
Plantago coronopus, P. major, P. media.

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plantaginis, Aphis Schrank, 1801. Fauna Boica, II, p. 106.
Achillea millefolium, A. ptarmica, Artemisia absinthium, A. campestris, A. vulgaris, Bellis perennis, Capsella bursa-pastoris, Chrysanthemum leucanthemum, Daucus carota, Epilobium molle, Erigeron canadensis, Gossypium herbaceum, Inula squarrosa, Leontodon taraxici, Leonurus cardiaca, Lynchnis dioica, Plantago lanceolata, P. major, P. media, Taraxacum officinale, Viola odorata.

***plantaginis, Aphis** Goeze, 1778. Entomologische Beitrage, p. 318. no. 33.

platani, Lachnus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 152.
Platanus occidentalis, Ulmus campestris.

platanicola, Lachnus Riley, 1883, Amer. Nat., XVII, p. 198.
Platanus occidentalis.

platanoides, Aphis Hartig, 1841. Zeit. Ent. (Germar), III, p. 369. **Acer.**

platanoides, Drepanosiphum (Schrank), 1801. Fauna Boica, II, p. 112. **Aphis.**
Acer campestre, A. platanoides, A. pseudo-platanus, Platanus occidentalis.

***poae, Aphis** Hardy, 1850. North British Agriculturist, II, p. 112.
Poa sp.

poae, Macrosiphum (Macchiati), 1885. Bul. Soc. Ent. Ital., XVII, p. 62. **Siphonophora.**
Bromus sterilis, Poa annua, Rubus idaeus.

poae, Rhizobius Thomas, 1879, Eighth Rept. State Ent. Ill., p. 166.
Poa annua.

poae, Rhizobius Buckton, 1883. Mon. Brit. Aphides, IV, p. 93, fig.
Poa annua.

poae, Rhopalosiphum Williams, as a var. of **R. dianthi** Schrank which see

poae, Rhopalosiphum Gillette, 1908. Can. Ent., XL, p. 61, fig.
Poa pratensis.

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podograriae, Aphis (Scopoli) Schrank, 1801. Fauna Boica, II, p. 110.
Schrank uses this name in referring to **Aphis aegopodii** Scopoli.

polanisiae, Aphis Oestlund, 1886. Aphididae of Minnesota, p. 42.
Polanasia graveolens.

polanisia-graveolens, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 17.
Polanasia graveolens.

pollinosa, Aphis Walker, 1849. The Zool. VII, p. 52.
Epilobium sp.

polyanthis, Aphis Passerini, 1863. Aphididae Italica, p. 164. p. 164.
Funkia subcordata.

polygala-senega, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic, Rev. III, p. 17.
Polygala senega.

polygoni, Aphis Macchiati, 1885. Bul. Ent. Soc. Ital., XVII, p. 63.
Polygonum aviculare.

polygoni, Aphis Van Der Goot, 1912. Tijdschr. voor Ent 55, p. 80, fig.
Polygonum fagopyrum, P. nodosum.

polygoni, Aphis Walker, 1848. The Zool. VI, p. 2249.
Polygonum aviculare.

polygoni, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 123, fig. **Siphonophora.**
Polygonum persicaria.

polygoni, Sipha Schouteden, 1907. Tijdschr. voor Ent., L. p. 265.
Polygonum aviculare.

pomi, Aphis DeGeer, 1773. Mems. des. Ins., III, p. 53, fig.
Ailanthus glandulosa, Cotoneaster interrigma, Crataegus crus-galli, C. oxyacantha, Cydonia vulgaris, Eriobotrya japonica, Laurus laurustinus Pyrus americana, P. aucuparia, P. communis, P. germanica, P. malus, Triticum vulgare.

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ponderosa, Lachnus Williams, 1911. Aphididae of Nebraska, p. 22.
Pinus ponderosa var. *scopulorum.*

popularia, Pemphigus Fitch, 1859. Fifth Rept. Nox. & Ben. Insects, N. Y., p. 849.
Populus balsamifera.

popularia, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 266.
Populus deltoides, P. fremonti, P. trichocarpa.

populea, Pterocomma (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 116. **Aphis.**
Populus alba, P. nigra, P. pyramidalis, Salix alba, S. caprea, S. nigricans, S. viminalis.

populeti, Aphis Panzer, 1801. Faun. Ins. Germ. Init. XXXII, p. 18.
Populus nigra, P. pyramidalis.

populeus Pterocomma var **longirotris,** (Mordwilko), 1901. Horae Soc. Ent. Ross. XXXIII, p. 414. **Cladobius.**
Populus sp., Quercus sp., Salix sp.

populi, Anuraphis Del Guercio, 1911. Redia, VII, p. 307, fig.
Populus balsamifera, P. nigra.

populi, Arctaphis (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Populus alba, P. grandidentata, P. nigra, P. pyramidalis, P. tremula, P. tremuloides, Salix amygdaloides, S. babylonica.

populi, Chermes Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir.. II, p. 83.
Populus alba.

populi, Cornaphis Gillette, 1913. Ann. Ent. Soc. Amer. p. 491, fig.
Populus angustifolia.

populi, Pemphigus Courchet, 1879. Rev. Sci. Nat. Montp., p. 90.
Populus nigra.

populi, Schizoneura Gillette, 1908. Ent. News, XIX, p. 1, fig.
Populus angustifolia, P. balsamifera, P. deltoides.

populicaulis, Thecabius (Fitch), 1859. Fifth Rept. Nox. & Ben. Insects, N. Y. p. 845. **Pemphigus.**
Populus balsamifera, P. deltoides, P. fremonti, P. nigra, P. pyramidalis, P. tremuloides, P. trichocarpa.

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populicola, Chaitophorus Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 10.
Populus angustifolia, P. balsamifera, P. deltoides, P. deltoides-angustifolia, P. fremonti, P. monilifera, P. tremuloides, P. trichocarpa.

populi-conduplifolius, Thecabius (Cowen), 1895. Hemiptera of Colorado, p. 115. **Pemphigus.**
Populus balsamifera, P. deltoides, P. monilifera, P. trichocarpa, Ranunculus californicus.

populifoliae, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 66.
Populus deltoides, P. fremonti, P. grandidentata.

populifoliae, Chaitophorus (Oestlund) Davis, 1910. Jour. Econ. Ent. III, p. 489. Davis shows that Oestlund was dealing with a new species not **A. populifoliae** Fitch, (Oestlund), 1887, Aphididae of Minnesota, p. 38.
Populus balsamifera, P. grandidentata, P. tremuloides.

populifolii, Eichochaitophorus Essig, 1912. Pom. Coll. Jour. Ent., IV, p. 722, fig.
Populus trichocarpa.

populi-globuli, Pemphigus Fitch, 1859. Fifth Rept. Nox. & Ben. Insects, N. Y., p. 850.
Populus balsamifera.

populi-monilis, (Thecabius) Riley, 1879. Bul. U. S. Geol. & Surv. Terr. V, No. 1, p. 13, fig. **Pemphigus.**
Populus angustifolia, P. balsamifera, P. deltoides-angustifolia, P. fremonti, P. monilifera, P. tremuloides, P. trichocarpa.

populi-ramulorum, Pemphigus Riely, 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 16.
Populus balsamifera, P. deltoides, P. fremonti.

populi-transversus, Pemphigus Riley, 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V. No. 1, p. 15, fig.
Populus balsamifera, P. deltoides, P. fremonti, P. monilifera, P. trichocarpa.

populi-venae, Pemphigus Fitch, 1859. Fifth Rept. Nox. & Ben. Ins., N. Y., p. 851.
Populus balsamifera.

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populneus, Thecabius Koch, 1857. Die Pflanzenläuse Aphiden, p. 295, fig.
Populus nigra.

populus-grandidentata, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Populus grandidentata.

populus-trepida, Aphis Refinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 16.
Populus tremuloides.

porosus, Myzus Sanderson, 1900. Twelfth Rept. Del. Agr. Exp. Sta., p. 205.
Fragaria sp.

portschinskyi, Macrosiphum Mordwilko, 1909. (Trudi) Bur. Ent. (Dept. of Agr.)? VIII, No. 3, p. 11.
Spiraea ulmaria.

portulacae, Myzus Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 235.
Portulaca oleracea.

poschingeri, Prociphilus Holzner, 1874. Stett. Ent. Zeit. XXV, pp. 221, 321, 324, fig. **Pemphigus.**
Abies balsamea, A. fraseri, Pinus sp.

potentillae, Aphis Walker, 1850. Ann. Mag. Nat. Hist. ser. 2, VI, p. 122.
Potentilla anserina.

potentillae, Macrosiphum (Oestlund), 1887. Aphididae of Minnesota, p. 83. **Nectarophora.**
Potentilla anserina.

potentillae, Myzus Williams, 1911. Aphididae of Nebraska, p. 65.
Potentilla anserina, P. arguta.

potentillae, Myzus Oestlund, 1886. Aphididae of Minnesota, p. 30.
Potentilla anserina.

praecox, Chermes Cholodkovsky, as a var. of C. lapponicus Cholodkovsky which see

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praeterita, Aphis Walker, 1849. The Zool. VII, p. 52, app.
Epilobium sp.

primulae, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII. No. 2, p. 91.
Primula kewensis, P. vulgaris.

prolifera, Phylloxera Oestlund, 1887. Aphididae of Minnesota, p. 16.
Populus sp. in galls of **Pemphigus populi-transversus** Riley, *Populcharatum, S. vulgare, Zea mays.*

propinquum, Macrosiphum Mordwilko, as a sub sp. of **M. cyparissiac** Koch which see.

protospirae, Pemphigus Lichtenstein, 1885. Mon. Peupl., p. 31, fig. Listed in La Flore des Aphidens, 1884.
Populus nigra, P. pyramidalis.

pruinosus, Lachnus Hartig, 1841. Zeit. Ent. (Germar), III, p, 368. No food plant given.

prunaria, Aphis Walker, 1850. Ann. Mag. Nat. Hist. VI, ser. 2, p. 121. Prunus domestica, P. spinosa.

pruni, Aphis Geoffroy, 1762. Histoire Abregee des Insectes, I, p. 497.

pruni, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 68, fig.
Prunus armeniaca, P. domestica, P. insititia, P. padus, P. spinosa.

pruni, Hyalopterus (Fabricius), 1775. Systema Entomologiae, (Fabricius), p. 735. **Aphis.**
Ammophila arundinacea, Phragmites sp., Prunus amygdalis, P. armeniaca, P. domesticus, P. insititia, P. persica, P. pissardi, P. spinosa, Pyrus malus.

pruni, Phorodon (Scopoli), 1763. Entomologia Carniolica, p. 138. **Aphis.**
Prunus sp.

pruni, Phorodon Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II. p. 60.
Prunus mahaleb.

pruni, Tetraneura Taschenberg, 1869. Brehms Illustrirtes Thierleben, VI, p. 514.
Prunus sp.

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prunicola, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 122. New name for **A. cerasi** Schrank.
Prunus domestica, P. persica, P. spinosa.

prunicoleus, Aphis Ashmead, 1881. Pacific Rural Press, XXII, No. 1, July 2, p. 8.
Prunus sp.

prunifoliae, Aphis Fitch, 1855. First Rept. Nox. & Ben. Insects N. Y. p. 122.
Prunus sp.

Prunina, Aphis Walker, 1850. Ann. Mag. Nat. Hist. VI, ser. 2, p. 120.
Prunus domestica, P. spinosa, Pyrus communis.

prunorum, Aphis Dobrowljansky, 1913. Zur. Biol. der Blattläuse der Obstbäume und Beerensträucher Ent. Sta. des Landwirstschaft. Syndikats in Kiew. p. 20, fig. ;
Prunus sp.

pseudobrassicae, Aphis Davis, 1914. Can Ent., XLVI, p. 231, fig.
Brassica spp., Raphanus sativus.

pseudobyrsa, Asiphum (Walsh), 1862. Proc. Ent. Soc. Phil., I, p. 306. **Byrsocrypta.**
Populus candicans, P. coccinea, P. deltoides, P. fremonti.

pseudocardui, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 120, fig.
Carduus sp.

pseudohieracii, Aphis Theobald, 1912. List of Aphididae of the Hastings District, p. 9.
New name for **Aphis hieracii** Buckton (not Kaltenbach).

pseudotsugae, Lachnus Wilson, 1912. Can. Ent. XLIV, p. 302.
Pseudotsuga douglassii.

***pskovica, Anoecia** Mordwilko, 1916. Revue Russian Entomology, XV, p. ?
"Grass roots."

ptarmicae, Microsiphum Cholodkovsky, 1908. Zool, Anz., XXXII, p. 687.
Achillea ptarmica.

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pteridis, Macrosiphum Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 101, fig.
Pteris aquilina.

pteridis, Mastapoda Oestlund, 1886. Aphididae of Minnesota, p. 53.
Pteris aquilina.

pteris-aquilinoides, Aphis Rafinesque, 1817. Amer. Mon. Mag. & Critic. Rev., I, p. 361.
Pteris aquilina.

pubescens, Trama Koch, 1857. Die Pflanzenläuse Aphiden, p. 308, fig.
Achillea millefolium.

pulegi, Aphis Del Guercio, 1911. Redia, VII, p. 320, fig.
Mentha pulegium.

pulvera, Aphis Walker, 1848. The Zool. VI, p. 2218.
Artemisia maritima.

pulverulens, Aphis Gillette, 1911. Jour. Econ. Ent., IV, p. 324, fig.
Symphoricarpos occidentalis.

punctatella, Monellia (Fitch), 1855. First Rept. Nox. & Ben. Insects N. Y., p. 165. **Aphis.**
Carya alba.

punctatus, Lachnus Burmeister, 1835. Hand, der Entomologie, II, p. 93.
Salix alba.

punctatus, Myzocallis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 30. **Callipterus.**
Quercus bicolor, Q. macrocarpa.

punctatus, Phylloxera Lichtenstein, 1876. Ann. Soc. Ent. Belg., XIX, p. 173.
Quercus fasciata, Q. robur.

punctipennis, Aphis Zetterstedt, 1828. Fauna Insectorum Lapponica. I, p. 559.
Alnus sp., Betula sp.

punicae, Aphis Passerini, 1863. Aphididae Italicae, p. 42.
Punica granatum, P. sylvestris.

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punicella, Aphis Theobald, 1915. Bul. Ent. Research, VI, p. 125, fig.
Punica granatum.

purpurea, Phylloxera Pergande, as a var. of **P. symmetrica** Pergande, which see.

purpurascens, Macrosiphum (Oestlund), 1887. Aphididae of Minnesota, p. 81. **Nectarophora.**
Thalictrum revolutum.

pyrarius, Myzus Passerini, 1861. Atti. Soc. Ital. Sci. Nat. III, p. 399.
Pyrus communis.

pyrastri, Aphis Boisduval, 1867. Essai sur Entom. Hort. p. 253.
Pyrus communis.

pyri, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 189.
Crataegus oxyacantha, Prunus domestica, Pyrus communis, P. coronaria, P. germanica, P. malus.

pyri, Aphis Hartig, 1841. Zeit. Ent. (Germar), III, p. 369.
Pyrus malus.

pyri, Aphis Kittel, 1827. Mems. Soc. Linn. Paris, V. p. 150.
Pyrus nobilis.

pyri, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 60, fig.
Pyrus communis, Tussilago farfare.

***pyri, Eriosoma** Westwood, 1849 The Gardeners' Chronicle, p. 755.
Pyrus.

pyri Lachnus Buckton, 1899. Ind. Mus. Notes, IV, p 274.
Pyrus communis.

pyri Prociphilus (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 68. **Eriosoma.**
Crataegus sp., Pyrus communis, P. malus.?

pyricola Erisoma Baker & Davidson, 1916. Jour. Agr. Research, Washington, D. C. VI, No. 10, p. 358. fig.
Pyrus communis, Ulmus sp.

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pyriformis, Pemphigus Lichtenstein, 1886. Mon. Peup. p. 29.
Listed in La Flore des Aphidens, 1884.
Populus nigra, P. pyramidalis.

pyrinus, Myzus Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 222.
Pyrus communis.

quadrituberculata, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 134.
Betula alba.

quaerens, Aphis Walker, 1849. The Zool. VII, p. 48 app.
Galeopsis ladanum.

quercea, Myzocallis (Kaltenbach), 1843. Mon. der Pflenzenläuse, p. 136. **Aphis.**
Quercus robur.

querceti, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 263.
Quercus alba, Q. dentata, Q. farnetto, Q. macrocarpa.

querci, Phyllaphis Fitch, 1859. Fifth Rept. Nox. & Ben. Insects N. Y., p. 804. **Eriosoma.**
Quercus agrifolia, Q. macrocarpa, Q. undulata.

quercicola, Callipterus? Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 31.
Quercus sp.

quercicola, Chaitophorus (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 32.
Quercus alba, Q. macrocarpa, Q. obtusiloba, Q. prinus.

quercicola, Phyllaphis Baker, 1916. Entomological News, XXVII, p. 362.
A new name for **Phyllaphis querci** (Fitch) Davis.
Quercus sp.

quercicola, Thalaxes Westwood, 1840. Intr. Mod. Class. Ins. 11.
See p. 118 of the Synopsis of the Genera of British Insects.
Quercus sp.

quercicolens, Lachnus Ashmead, 1881, Can Ent. XIII, p. 155.
Quercus virginiana.

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quercifoliae, Aphis Walsh 1862. Proc. Ent. Soc. Phil. I, p. 298.
Acer saccharinum, Platanus occidentalis, Quercus sp.

quercifoliae Chaitophorus (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 67. **Lachnus.**
Quercus alba.

quercifoliae, Phyllaphis Gillette, 1914. Ent. News XXV, p. 272.
Quercus sp.

quercifolii, Myzocallis (Thomas), 1879. Eighth Rept. State Ent. Ill., p. 112. **Callipterus.**
Quercus rubra, Ulmus racemosa.

quercina, Psylloptera Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. di Genova, II. p. 85.
Quercus cerris.

quercus, Cinara Mosley, 1841. The Gardners Chronicle, p. 747.
Quercus sp.

quercus, Myzocallis (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 98. **Aphis.**
Castanea pumila, Quercus douglasii, Q. ilex, Q. kelloggii, Q. lobata, Q. robur, Q. sessilifolia.

quercus Myzocallis var. insignis Ferrari, 1873. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 231.
Quercus sp.

quercus, Phylloxera Boyer de Fonscolombe, 1834. Ann. Soc. Ent. France, III. p. 223.
Quercus coccifera, Q. ilex, Q. robur, Q. "suber", Q. virginiana.

quercus, Stomaphis (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Quercus alba, Q. robur.

quercus-monticula, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist. I, p. 169. No description.
Quercus sp.

radicicola, Trifidaphis (Essig), 1909. Pom. Jour. Ent. I, p. 8, fig. **Pemphigus.**
Amaranthus retroflexus, Beta vulgaris, Solanum nigrum.

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radicis, Trama Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 211.
Artemisia campestris, A. vulgaris, Cirsium arvensis, Crepis biennis, Hieracium pilosella, Lactuca scariola, Leontodon taraxci, Ranunculus repens, Sonchus oleraceus Taraxacum officinale.

radicola, Aphis Mordwilko, 1896. Horae Soc. Ent Ross., III, p. 21, fig.
Arctium sp., Rumex crispus.

radicola, Tychea Oestlund, 1886. Aphididae of Minnesota, p. 56.
Ambrosia trifida.

***radicum, Forda** Goureau, 1861. Bul. Soc. Sci. Hist. Nat. Yonne, part 2, p. 259.
Cichorium intybus, Cynara scolymus.

radicum, Pemphigus (Boyer de Fonscolombe), 1841 Ann. Soc. Ent. France, X. p. 195. **Aphis.**
Anthemis nobilis, Avena sativa, Coix lachryma-jobi. Cynodon dactylon, Echinochloa crus-galli, Eragrostis megastachya, Hieracium pilosella, Lolium perenne, Oryza sativa, Sorghum saccharatum, S. vulgare, Zea mays.

ralumensis, Schoutedenia Rubsaamen, 1905. Marcellia, IV, p. 19.
Glochidion philippense.

ranunculi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 69.
Ranunculus acris, R. muricatus, R. repens.

ranunculi, Myzus Del Guercio, 1900, Nuov. Relaz. Staz. Agr. Fir. II, p. 151.
Ranunculus velutinus.

ranunculi, Pemphigus Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 185.
Ranunculus acris, R. auricomus, R. bulbosus, R. flammula, R. repens.

ranunculi, Pemphigus Davidson, 1910. Jour. Econ. Ent., III, p. 372.
Ranunculus californicus.

ranunculi, Trama Del Guercio, 1909. Redia, V. p. 248, fig.
Ranunculus velutinus.

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ranunculina, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1046.
Ranunculus sp?

rapae, Rhopalosiphum (Curtis), 1842. Jour. Royal Agri. Soc., III, p. 53, fig. **Aphis.**
Garden vegetables.

raphani, Aphis Schrank, 1801. Fauna Boica, II, p. 119.
Raphanus sativus.

rara, Trama Mordwilko, 1908, L'annuaire du Musee Zool. L'Acad. Imp. Sci. St. Petersburg, XIII, p. 373.
Only reference known to me although there seems to be another.
Taraxacum sp.

reaumuri, Schizoneura Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 175.
Tilia cordata, T. grandifolia, T. platyphyllos, T. tomentosa, T. vulgaris.

reducta, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1044.
Artemisia abrotanum? (Sea wormwood.)

redundans, Aphis Walker, 1849. The Zool. VII, p. 32, app.
Crambe maritima.

relata, Aphis Walker, 1849. The Zool. VII, p. 44, app. altissimus.
Rumex altissimus.

reticulata, Aphis Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 92, fig.
Artemisia tridentata.

retroflexus, Pemphigus Courchet, 1879. Rev. Sci. Nat. Montp. p. 25.
Pistacia lentiscus.

rhamni, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 64.
Alnus vulgaris, Brassica juncea, Origanum vulgare, Rhamnus alaternus, R. alpina, R. frangula, R. lanceolata.

rhamni, Macrosiphum (Clarke), 1903. Can. Ent. XXXV, p. 254. **Nectarophora.**
Rhamnus californica.

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rhamni, Myzus (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 177. **Aphis.**
Rhamnus alpina, R. cathartica, R. frangula, R. purshiana.

rhei, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 127, fig.
Rheum rhaponticum.

rhinanthi, Amphorophora (Schouteden), 1903. Zool. Anz., XXVI, p. 687. **Nectarosiphum.**
Rhinanthus minor.

rhodryas, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Rosa sp.

rhois, Liosomaphis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 27. **Rhopalosiphum.**
Avena sativa, Elymus sp., Hordeum murinum, Phleum pratense, Rhus glabra, R. trilobata, Triticum sativum.

rhois, Melaphis (Fitch), 1866. Jour. N. Y. Agr. Soc., XVI, p. 73, August. **Byrsocrypta.**
Rhus glabra, R. typhina.

ribesina, Rhopalosiphum Van Der Goot, 1912. Tijdschr. voor Ent. deel LV, p. 75.
Ribes nigrum.

ribicola, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 33. **Aphis.**
Crepis biennis, C. capillaris, C. viridis, Ribes grossularia.

ribis, Aphis Sanborn, 1904. Kansas Aphididae, p. 46.
Ribes vulgare.

***ribis, Aphis** Müller, 1776. Zoologiae Danicae Prodomus, p. 110, fig.

ribis, Myzus (Linnaeus), 1758. Edition 10, System Naturae, p. 451. **Aphis.**
Deutzia scabra, Lippia citriodora, Ribes alpinum, R. aureum, R. grossularia, R. nigrum, R. rotundifolium, R. viscossisium, R. vulgare, Sonchus arvensis, S. oleraceus, Viburnum opulus.

ribis, Myzus Linnaeus, ver **bucktonii,** Del Guercio, 1894. IL Naturalista Siciliano XIII, p. 197.
Ribes sp.

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ribis, Myzus Linnaeus var. **trifasciata,** Del Guercio, 1894. IL Naturalista Siciliano, XIII, p. 197.
Ribes vulgare.

riccobonii, Pemphigus Stefani, 1899. Riv. Ital. Sci. Nat., XIX, p. 1.
Pistacia atlantica.

rileyi, Lachnus Williams, 1911. Aphididae of Nebraska, p. 24.
Pinus strobus, P. sylvestris.

rileyi, Pemphigus? Stebbins, 1910. Springfield Mus. Nat. Hist., Bul. 2, p. 9, fig.
Populus tremuloides.

rileyi, Phylloxera Riley, 1874. Sixth Rept. Nox & Ben. Insects Mo., p. 64.
Quercus alba, Q. bicolor, Q. obtusiloba.

rileyi, Eriosoma Thomas, 1877. Trans. Ill. Hort. Soc. p. 191.
New name for **Eriosoma ulmi** Riley.
Ulmus americana.

rimosalis, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX. p. 217.
Carya alba.

ripariae, Aphis Oestlund, 1886, Aphididae of Minnesota, p. 41.
Vitis cordifolia, V. vulpina.

***rparius, Dryobius** Snellen Van Vollenhoven, 1862. Tidjschr. Ent. Ned. Ent. Ver., V, p. 95, pl. 5, pp. 1—3.
Food plant?

rjabushinskiji, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd, app. p. 5.
Food plant?

robiniae, Aphis Macchiati, 1885. Bul. Soc. Ent. Ital., XVII, p. 65.
Ribinia pseudo-acacia?

robiniae, Callipterus Gillette, 1907. Can. Ent. XXXIX, p. 395, fig.
Ribinia pseudo-acacia.

roboris, Pterochlorus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Fagus sylvatica, Picea abies, Pinus sylvestris, Quercus cerris, Q. ilex, Q. robur.

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roboris Pterochlorus var. **nigra**, Del Guercio, 1909. Redia, V. p. 275, fig.
Quercus cerris.

roboris Pterochlorus Linnaeus, var. **breviorostris**, Mordwilko, 1908. L'Ann. Musee Zool. L'Acad. Imp. Sci., St. Petersburg, XIII, p. 378.

robusta, Aphis Walker, 1849, The Zool. VII, p. 43, app.
Pastinaca sativa.

rociadae, Aphis Cockerell, 1903. Trans. Amer. Ent. Soc. XXIX, p. 115.
Delphinium sapellonis.

rogersii, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 3, p. 126.
Fragaria sp.

rorea, Endeis Koch, 1857. Die Pflanzenläuse Aphiden, p. 313, fig.
Puccinellia distans. Many unknown weeds.

rosae, Lachnus Cholodkovsky, 1899. Zool. Anz. XXII, p. 471 fig.
Rosa canina.

rosae, Macrosiphum (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Centranthus sp., Dipsacus pilosus, D. strigosus, D. sylvestris, Euphorbia peplus, Rosa canina, R. centifolia, R. eglanteria, R. lutea, R. rubiginosa, R. spinosis—sima, Scabiosa arvensis, S. columbaria, S. succisa, Valeriana officinalis.

rosae, Macrosiphum var. **glauca** (Buckton) 1876. Mon. Brit. Aphides, I. p. 109, fig. **Siphonophora.**
Rosa canina, R. centifolia.

rosaecola, Macrosiphum (Passerini), 1871. Bul. Ent. Soc. Ital., III, p. 336. **Siphonophora.**
Rosa rubiginosa.

rosaefolium, Macrosiphum Theobald, 1915. Bul. Ent. Research, VI, p. 109, fig.
Rosa sp.

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rosaeollae, Macrosiphum Theobald, 1915. Bul. Ent. Research, VI, p. 111, fig.
Rosa sp.

rosarum, Lachnus Van Der Goot, 1912. Mitteilungen aus dem Natur-historischen Museum, XXIX, p. 279.
Rosa sp.

rosarum, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 180, fig. **Siphonophora.**
Rosa sp.

rosarum, Myzus (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 101. **Aphis.**
Potentilla anserina, Rosa calif arnica, R. canina, R. centifolia, R. gallica, R. rubiginosa, R. rugosa, R. spinosissima.

rosa-suaveolens, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 16.
Rosa rubiginosa.

***roseus, Myzus** Macchiati, 1881. Riv. Sci. Ind. Guid. Vim. Fir. Firenze p. ?
Rosa centifolia, R. gallica, Yucca sp.

rossica, Colopha Cholodkovsky, 1897. Zool. Anz., XX, p. 146, fig. Also p. 212, Hor. Soc. Ent. Ross.
Triticum vulgare.

rotunda, Forda Theobald, 1914. The Entomologist, XLVII, p. 30, fig.
In nest of **Tapinoma erraticum.**

rotundiventris, Schizoneura Signoret, 1860. Ann. Soc, Ent. France, VIII, p. 178.
No food plant given.

rubi, Macrosiphum (Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 24. **Aphis.**
Cytisus scoparius, Epilobium montanum, Geum urbanum, Rubus caesius, R. corylifolius, R. discolor, R. fructicosus, R. idaeus, R. occidentalis, R. villosus.

rubi, Pemphigus Thomas, 1879. Eighth Rept. State Ent. Ill., p. 147.
Rubus occidentalis.

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rubicola, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 60.
Rubus idaeus.

rubicola, Nectarosiphon (Oestlund), 1886. Aphididae of Minnesota, p. 27. **Macrosiphum.**
Rubus idaeus, R. nutkanus.

rubicula, Aphis Haldeman, 1844. Proc. Bos. Soc. Nat. Hist. I, p. 169.
No food plant given.

rubicundus, Lachnus Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 104.
Juniperus communis.

rubiellum, Macrosiphum Theobald, 1913. Jour. Econ. Biology, VIII, No. 3, p. 147.
Rubus fruticosus, R. idaeus.

rubifolii, Cerosipha (Thomas), 1879. Eighth Rept. State Ent. Ill., p. 121. **Sipha.**
Rubus occidentalis, R. villosus.

rubiphila, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 269, fig.
Rubus sp.

rubra, Tetraneura Lichtenstein, 1880. Fenill. Jeun. Nat. X, p. 125.
Ulmus campestris.

***rubrum, Myzus** Macchiati, 1880. Riv. Sci. Ind. Fir. p. ?
Yucca sp.

rudbeckiae, Macrosiphum (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 66. **Aphis.**
Ambrosia trifida, Aster drummondii, Baccharis viminea, Bidens laevis, Cacalia suaveolens, C. tuberosa, Cirsium arvense, Dipsacus fullonum, Lactuca muralis, L. sacriola, Mulgedium sp., Rudbeckia amplexicaulis, R. laciniata, Silphium integrifolium, S. perfoliatum, Solidago rigida, S. serotina, Sonchus oleraceus, Synosma suaveolens, Vernonia fasciculata, V. lindheimeri, V. noveboracensis.

rudbeckiarum, Macrosiphum (Cockerell), 1903. Can. Ent. XXXV, p. 168. **Nectarophora.**
Rudbeckia amplexicaulis.

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rufa, Macrosiphum Monell, as a var. of **M. liriodendri** Monell, which see.

rufipes, Aphis Hartig, 1841. Zeit. Ent. (Germar) III, p. 369. No food plant given.

rufomaculata, Coloradoa (Wilson), 1908. Ent. News, XIX, p. 261. **Aphis.**
Chrysanthemum coccineum.

rufula, Aphis Walker, 1849. The Zool. VII, p. 47, app.
Salsola kali.

rufulus, Pterocomma (Davidson), 1909. Jour. Econ. Ent. II, p 300. **Cladobius.**
Populus sp., Salix sp.

rugicornis, Tetraneura Hartig, 1841. Zeit. Ent. (Germar), III, p. 366, no description.

rumicis, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 451.
Achillea millefolium, A. ptarmica, Aegopodium podagraria, Aethusa cynapium, Amaranthus caudatus, A. graecizans, Anagallis arvensis, Angelica archangelica, A. sylvestris, Anthemis nobolis, Anthriscus vulgaris, Arctium lappa, A. minus, Asparagus officinalis, Atriplex hastata, A. hortensis, A. patula, Benincasa cerifera, Berteroa incana, Beta vulgaris, Borago officinalis, Brassica campestris, B. oleracea, B. rapa, Buxus sempervirens, Capsella bursapastoris, Caucalis latifolia, Centaurea calcitrapa, Centranthus sp., Cercis siliquastrum, Chenopodium album, C. hybridum, Chrysanthemum leucanthemum, C. segetum, Cichorium endiva, C. intybus, Cimicifuga sp., Cirsium arvense, C. lanceolatum, C. muticum, C. palustre, Cochlearia armoracia, Conium maculatum, Crataegus oxyacantha, Cynoglossum sp., Cyperus laevigatus, C. rotundus, Cytisus scoparius, Dahlia coccinea, D. nutans, D. varabialis, Datura stramonium, Daucus carota, Deutzia scabra, Digitalis lutea, D. purpurea, Dipsacus pilosus, Duchesnea indica, Epilobium alsinifolium, Erica gracilis, Erigeron sp., Erodium cicutarium, Eryngium campestre, Euphorbia sp., Evonymus atropurpureus, E. europaeus, E. maackii, Fragaria sp., Fumaria capreolata, F. officinalis, Galium aparine, G. mollugo, G. verum, Genista, anglica, G. germanica, G. ovata, G. tinctoria, Gladiolus sp., Hypericum hirsutum, H. montanum, H. perforatum, H. quadrangulum, Ilex aquilfolium, Inula dysenterica, I. viscosa, Jasminum officinale, Laburnum anagyroides, Lamium purpureum, Lotus cornicula-

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tus, Lycopersicum esculentum, Lysimachia sp., Magnolia sp., Matricaria chamomilla, Melilotus alba, Mentha aquatica, Myosotis "scorpioides," Nerium oleander, Opuntia fiscus-indica, Ornithopus sp., Papaver hydrolapathum, P. rhoes, P. somniferum, Pastinaca sativa, Petroselinum hortense, Peucedanum alsaticum, P. typherr, Phaseolus coccineus, P. vulgaris, Philadelphus grandiflorus Picris sp., Pisum sp., Polygonum fagopyrum, P. persicaria, Pyrus communis, Ranunculus acris, Reseda sp., Rheum rhaponticum, Rhodolypus kerriaides, Ribes aureum, Robinia pseudo-acacia, Rumex acetosa, R. acetosella, R. acutus, R. altissimus, R. amplexicaulis, R. conglomeratus, R. crispus, R. hydrolapathum, R. intermedius, R. obtusifolius, R. pulcher, R. venosus, Salix alba, S. amygdaeoides, S. babylonica, S. caprea, Scorconeura hirsuta, Senecio mikanioides, S. vulgaris, Sium latifolium, Solanum dulcamara, S. jasminoides, S. nigrum, S. tuberosum, Solidago serotina, S. virgaurea, Spartium junceum, Spinacia oleracea, Spiraca chamardryfolia, Steironema ciliatum, "Tamarix," Thlaspi sp., Thymus serpyllum, Tragopogon pratensis, Trifolium sp., Tropaeolum sp., Tulipa sp., Ulex europaeus, Urtica urens, Valeriana officinalis, Verbena officinalis, Viburnum opulus, Vicia cracca, V. faba, V. lutea, V. pseudocracca, Vigna actijang, Zea mays.

rutila, Phylloxera Dreyfus, 1889. Zool. Anz. XII, p. 95.
Vitis vinifera? without a definite description.

saccharata, Pemphigus Del Guercio as a var. of **P. fuscifrons** Koch, which see.

saccharata, Pemphigus Del Guercio as a var. of **P. boyeri** Passerini, which see.

sacchari, Aphis Zehntner, 1897. Archief Java Suiker Ind. V, p. 551.
Saccharum officinarum.

saccharinus, Myzocallis Del Guercio, 1913. Redia IX, p. 210, fig.
Fagopyrum sp.

sacculi, Asiphum Gillette, 1914. Ann. Ent. Soc. Amer. VII, p. 65.
Populus tremuloides.

salicariae, Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 144, fig.
Epilobium sp., Lythrum salicaria, Salix sp.

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salicellis, Lachnus? Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p., 67.
Salix sp.

saliceti, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 103.
Salix aurita, S. babylonica, S. caprea, S. cinerea, S. fragilis, S. purpurea, S. viminalis.

salicicola, Aphis (Thomas), 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 8. **Siphonophora.**
Salix amygdaloides, S. discolor.

salicicola, Chaitophorus Essig, 1911. Pom. Coll. Jour. Ent. 3, p. 532, fig.
Populus trichocarpa, Salix laevigata.

salicicola, Lachnus Uhler, 1862. Flint Ed. Harris Ins. Ing. to Veg., p. 239.
New name for **Aphis salicti** Harris.

salicicorticis, Symdobius Essig, 1912. Pom. Coll. Jour. Ent. 4, p. 731, fig.
Salix laevigata.

salicina, Aphis Zetterstedt, 1840. Ins. Lapp. I, p. 311.
Salix sp.?

saliciradicis, Fullawaya Essig, 1912. Pom. Coll. Jour. Ent. 4, p. 737, fig.
Salix laevigata.

***salicis, Aphis** Müller, 1776. Zool. Dan. Prod., p. 110.
Salix sp.

salicis, Aphis Sulzer, 1776. Abgek. Gesch. Ins., p. 105, fig.
Salix sp.

salicis, Chaitophorus Williams, 1891. Special Bul. No. 1, Univ. Nebraska, Dept. of Ent., p. 27. No description.
Salix sp.

salicis, Pterocomma (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Aphis.**
Populus candicans, Salix alba, S. caprea, S. cinerea, S. fragilis, S. longifolia, S. lucida, S. pentandra, S. triandra, S. viminalis.

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***salicis-farinosa, Aphis** Linnaeus, 1789. Entomologia, p. 550, no. 40.

salicis, Pemphigus Lichtenstein, 1884. La Flore des Aphidens, p. 47. No description.
Salix sp.

salicis, Phylloxera Lichtenstein, 1884. Ann. Soc. Ent. France, (6) IV, p. CXXII.
Salix sp.

salicis, Siphocoryne Monell, 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 26.
Salix babylonica, S. longifolia, S. lucida, S. nigra.

salicivora, Chaitophorus (Walker), 1848. Ann. Mag. Nat. Hist. ser. 2, I,, p. 453. **Aphis.**
Avena fatua, Dactylis glomerata, Salix saprea, S. cinerea, S. fragilis, S. lapponum, S. purpurea.

salicti, Chaitophorus (Schrank), 1801. Fauna Boica, II, p. 103. **Aphis.**
Populus alba, Salix alba, S. caprea, S. cinerea, S. nigricans.

salicola, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 267.
Salix discolor, S. lasiolepis.

salicti, Pterocomma (Harris), 1841. Ins. Inj. to Veg., Mass., p. 191. **Aphis.**
Acer saccharum, Populus deltoides, Salix sp., Salvia aethiopsis.

***saligna, Lachnus** Gmelin, 1788. Systema Naturae, I, p. 2209, No. 62. A new name for **Aphis salicis** Sulzer.
Salix.

salviae, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1043.
Salvia ceratophylloides, S. pratensis.

sambucaria, Aphis Passerini, 1860. Gli Afidi, p. 36.
Sambucus nigra.

sambuci, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 451.
Agave sp., Funkia subcordata, Lemna minor, Piltasporum tobira, Sambucus canadensis, S. ebulus, S. nigra.

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***sambuci, Aphis** Müller, 1776. Zoologiae Danicae Prodromus, p. 110, fig.
Sambucus.

sambucifoliae, Aphis Fitch, 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 66.
Sambucus canadensis, S. nigra.

sanborni, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 225, p. 52.
Ribes sp.

sanborni, Macrosiphum Gillette, 1908. Can. Ent., XL, p. 65, fig.
Chrysanthemum sp. (In greenhouses.)

sanguisorbae, Aphis Schrank, 1801. Fauna Boica, II, p. 106.
Sanguisorba sp.

saniculae, Aphis Williams, 1911. Aphididae of Nebraska, p. 56.
Sanicula canadensis.

sassceri, Aphis Wilson, 1911. Can. Ent., XLIII, p. 59.
Anona rectilinata.

sativae, Aphis Williams, 1911. Aphididae of Nebraska, p. 56.
Cannabis sativa.

scabiosae, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 63.
No description.

scabiosae, Aphis Scopoli, 1763. Entomologia Carniolica, p. 138.
Ballota nigra, Capsella bursa-pastoris, Galium cruciata, Hieracium umbellatum, Nicotiana rustica, Parietaria officinalis, Scabiosa arvensis, S. columbaria, S. succisa, Solanum giganteum.

scabiosae, Macrosiphum (Schrank), 1801. Fauna Boica II, p. 105. Aphis.
Capsella bursa-pastoris, Hypericum sp., Scabiosa arvensis, S. colmubaria, S. succisa, S. sylvatica, Spirea ulmaria.

schoutedeni, Sipha (Del Guercio), Shouteden, 1900. Ann. Soc. Ent. Belg., XLIV, p. 134.
Holcus sp.

scirpi, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V. p. 153.
"Scirpe" sp.

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scirpi, Toxoptera Passerini, 1874. Bul. Ent. Soc. Ital., VI, p. 137.
Scirpus lacustris, S. cernuus.

scirpus, Saltusaphis Theobald, 1915. Bul. Ent. Research, VI, p. 138, fig.
Scirpus sp.

scorodoniae, Aphis Del Guercio, 1911. Redia, VII, p. 317, fig.
Teucrium scorodonia.

scrophulariae, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 137, fig. Siphonophora.
Schrophularia scorodonia.

scrophulariae, Phorodon Thomas, 1879. Eighth Rept. State Ent. Ill., p. 72.
Scrophularia marylandica.

scutifera, Phylloxera Signoret, 1867. Ann. Ent. Soc. France, (4), VII, p. 303, fig.
Quercus sp.

secunda, Aphis Walker, 1849. The Zool. VII, p. 44, app.
Salix caprea.

sedi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 63.
Sedum acre, S. album, S. maximum, S. reflexum, S. telephium.

sejuncta, Aphis Walker, 1848. The Zool. VI, p. 2247.
Cedrus libani.

***semilunarius, Pemphigus** Passerini, 1856. Giornale Giardini, III, p. 261.
Pistacia terebinthus.

senecionis, Aphis Williams, 1911. Aphididae of Nebraska, p. 57.
Senecio canus.

senecionis, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 95.

serotinae, Rhopalosiphum Oestlund, 1887. Aphididae of Minnesota, p. 76.
Pyrus malus, Solidago rigida, S. serotina.

serpylli, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 92, fig.
Thymus serpyllum.

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serratulae, Macrosiphum Schrank, 1801. Fauna Boica II, p. 122. Aphis.
Cirsium arvense, Cnicus oleraceus.

serrulatus, Atheroides Haliday, 1839. Ann. Nat. Hist. Mag., II, p. 189.
Grasses.

seselii, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 49. No description.
Seseli sp.

setariae, Aphis (Thomas) 1877. I, 11 State Lab. Nat. Hist. Bul. 2, p. 5. Siphonophora.
Digitaria sanguinalis, Echinochloa crus-galli, Eleusine indica, Muehlenbergia schreberi, Panicum dichotomiflorum, P. polyanthes, P. proliferum, Prunus sp., Psedera quinquefolia, Setaria glauca, S. viridis.

setariae, Tychea Passerini, 1860. Gli Afidi, p. 40.
Coix lachryma-jobi, Digitaria humifusa, Lactuca virosa, Oryza sativa, Setaria glauca, S. verticillata, S. viridis, Triticum vulgare, Zea mays.

setosa, Aphis Kaltenbach, 1846. Ent. Zeit. (Stettin), VII, p. 172.
Cytisus scoparius.

setulosa, Tychea Passerini, 1860. Gli Afidi, p. 40.
Oryza sativa, Setaria sp.

shelkovnikovi, Rectinasus Mordwilko, 1916. Revue Russian Entomology, XV, p. ?
From ant hill.

shepherdiae, Capitophorus Gillette & Bragg, 1916. Ent. News, XXVII, p. 445, fig.
Shepherdia argentea.

sibiricum, Acyrthosiphon (Microlophium) Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 224.
Urtica dioica.

sibiricum, Acyrthosiphon (Microlophium) Mordwilko, sub sp. **kirgiz**, Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera,) I, Petrograd, p. 235.
Urtica dioica.

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sibiricum, Acyrthosiphon (Microlophium) Mordwilko, sub. sp. **sibiricum,** Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 226, fig.
Urtica dioica.

sibiricus, Chermes Cholodkovsky, 1889. Zool. Anz., XII, p. 391.
Picea abies, P. orientalis, Pinus cembra, P. strobus, P. sylvestris.

signoreti, Phylloxera Targioni Tozzetti, 1875. Bul. Soc. Ent. Ital., VII, p. 302.
Quercus sp.

sii Aphis Koch, 1855. Die Pflanzenläuse Aphiden, p. 137, fig.
Falcaria vulgaris.

silenea, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 72.
Silene cucubalus, S. latifolia.

sileneum, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 3, p. 143.
Silene latifolia.

silybi, Aphis Passerini, 1861. Att. Soc. Ital. Sci. Nat., III, p. 400.
Borago officinalis, Nerium oleander, Silybum marianum, Solanum guianense, S. nigrum.

similis, Aphis Walker, 1848. The Zool. VI, p. 2249.
Prunus domestica.

similis, Capitophorus Van Der Goot, 1915. Beiträge zur Kenntnis den Hollandischen Blattläuse Haarlem, p. 127.
Tussilago farfara.

similis, Chermes Gillette, 1907. Proc. Acad. Nat. Sci. Phil., p. 15, fig.
Picea abies, P. canadensis, P. mariana, P. pungens, P. rubra.

sinensis, Aphis Del Guercio, 1900. Nuov. Rel. R. Staz. Ent. Agr. Fir., II, p. 137.
Lilium sp.

sinensis, Schlectendalia (Walker), 1852. List. Hom. Brit. Museum, part 4, p. 1058. **Aphis.**
Rhus samialata.

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sisymbrii, Macrosiphum (Buckton), 1876. Mon. Brit. Aphides, I, p. 160, fig. **Siphonophora.**
Sisymbrium alliaria, S. officinale.

sisymbrii, Rhopalosiphon Del Guercio, 1913. Redia, IX, p. 163, fig.
Sisymbrium arnottianum.

skrjabini, Acyrthosiphon Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., p. 181.
Malva neglecta.

smaragdinum, Drepanosiphum Koch, 1855. Die Pflanzenläuse Aphiden, p. 205, fig.
Populus nigra, P. pyramidalis.

smilacis, Lachnus Williams, 1911. Aphididae of Nebraska, p. 24.
Smilax herbacea.

smithiae, Pterocomma (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 32. **Chaitophorus.**
Salix alba, S. smithiana.

socia, Aphis Walker, 1848. The Zool. VI, p. 2217.
Cynoglossum officinale.

sodalis, Aphis Walker, 1848. The Zool. VI, p. 2218.
Cynoglossum officinale.

solanella, Aphis Theobald, 1914. Bul. Ent. Research, IV, p. 325, fig.
Solanum sp.

solani, Aphis Kittel, 1827. Mem. Soc. Linn. Paris, V, p. 151.
Solanum dulcamara, S. nigrum, S. villosum.

solani, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 15. **Aphis.**
Atropa belladona, Convulus althaeoides, Cydonia vulgaris, Heliotropium europaeum, Lychnis dioica, Satureja vulgaris, Solanum jasminoides, S. nigrum, S. tuberosum.

solani, Megoura Thomas, 1879. Eighth Rept. State Ent. Ill., p. 73.
Lycopersicum esculentum, Solanum sp.

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solanifolii, Macrosiphum (Ashmead), 1882. Can. Ent. XIV, p. 92. **Siphonophora.**

Amaranthus retroflexus, Aster sp., Brassica rapa, Capsella bursa-pastoris, Chenopodium album, Cineraria sp., Fagopyrum esculentum, Gladiolus sp., Iris sp., Lactuca sp., Phaseolus vulgaris, Physalis sp., Pisum sativum, Pyrus malus, Rosa sp., Solanum jasminoides, S. melongena, S. tuberosum, Sonchus oleraceus.

solanina, Aphis Passerini, 1863. Aphididae Italicae, p. 41.

Solanum elaegnifolium, S. sodomeum.

soldatovi, Acyrthosiphon Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 168.

Spiraea sp.

solidaginifoliae, Aphis Williams, 1911. Aphididae of Nebraska, p. 58.

Solidago canadensis.

solidaginis, Macrosiphum (Fabricius), 1781. Species Insectorum, II, p. 384. **Aphis.**

Campanula rotundifolia, Centaurea cyanus, Erigeron acris, E. canadensis, Scabiosa arvensis, Solidago canadensis, S. serotina, S. virgaurea.

sonchella, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr., V, p. 21. **Siphonophora.**

Sonchus oleraceus.

sonchi, Macrosiphum (Linnaeus), 1767. Systema Naturae, Ed. 12, p. 735. **Aphis.**

Achillea millefolium, Aster linosyris, Brassica nigra, Campanula erinus, C. rotundifolia, C. trachelium, Carduus acanthoides, C. crispus, C. nutans, C.pycnocephalus, Centaurea calcitrapa, C. collina, C. cyanus, C. jacea, C. nigra, C. nigrescens, C. scabiosa, Chrondrilla juncea, Chrysanthemum indicum, C. segetum, Cichorium endiva, C. intybus, Cirsium arvense, C. lanceolatum, C. muticum, C. spinosissimus, Cnicus oleraceus, Crepis biennis, C. capillaris, C. foetida, C. lampsanoides, Cynara cardunculus, Hieracium murorum, H. sylvaticum, H. sylvestris, H. umbellatum, Hyoseris radiata, Lactuca scariola, Lapsana communis, Leontondon autumnalis, L. hispida, Macrophylla sp., Onopordon acanthium, O. illyricum, Picridum vulgare, Picris hieraciodes, Sisymbrium alliaria, S. officinale, Solanum tuberosum, Sonchus arvensis, S. asper, S. oleraceus, Specularia speculum.

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sonchi, Rhizobius Passerini, 1860. Gli Afidi, p. 39.
Achillea millefolium, Cichorium endivia, C. intybus, Fragaria vesca, Galeopsis ladanum, Sonchus arvensis, S. asper, S. oleraceus, Stachys annua.

sonchi, Rhopalosiphum Oestlund, 1886. Aphididae of Minnesota, p. 34.
Sonchus asper.

sorbi, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 70.
Crataegus oxyacantha, Plantago major, Prunus avium, Pyrus aucuparia, P. communis, P. malus, P. torminalis, "Tamarantia sp.," Viburnum latana.

sorghella, Aphis Schouteden, 1906. Ann. Soc. Ent. Belg. L, p. 135.
Sorghum sp.

sorghi, Aphis Theobald, 1904. First Rept. Wellc. Lab., p. 43, fig.
Sorghum vulgare.

sparthani, Schizoneura Boisduval, 1866. Bul. Soc. Ent. France, (4), VI, p. LX.
Cytisus scoparius, Spartium junceum.

spartii, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 172, fig. **Siphonophora.**
Cytisus scoparius.

spectabilis, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 64.
Salix speciosa.

spicatus, Rhizobius Hart, 1894. Eighteenth Rept. Nox. & Ben. Insects, Ill., p. 104, fig.
Panicum dichotomiflorum, P. proliferum, Zea mays.

spinarum, Aphis Hartig, 1841. Zeit. Ent. (Germar) III, p. 370.
Prunus spinosa.

spinosa, Phylloxera (Shimer), 1869. Trans. Amer. Ent. Soc., II, p. 397. **Dactylosphaera.**
Carya cordiformis.

spinosus, Chaitophorus Oestlund, 1886. Aphididae of Minnesota, p. 49.
Quercus macrocarpa.

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spinosus, Hamamelistes Shimer, 1867. Trans. Amer. Ent. Soc., I, p. 284.
Betula alba, B. fontinalis, B. nigra, Hamamelis virginiana.

spinuloida, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 247.
Carya sp.

spinulosa, Phylloxera Targioni-Tozzetti, 1875. Bul. Soc. Ent. Ital., VII, p. 308.
Quercus cerris, Q. robur.

spinulosus, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 5. No description.

spiraeae, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 68.
Spiraea salicifolia.

spiraeae, Aphis Schouteden, 1902. Zool. Anz., XXV, p. 656.
Spiraea prunifolia, S. salicifolia, S. ulmaria, S. vanhoutei.

spiraecola, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 270, fig.
New name for **Aphis spireaella** (Schouteden) Gillette.

spiraecola, Macrosiphum Patch, 1914. Me. Agr. Exp. Sta., Bul. No. 233, p. 271, fig.
Spiraea vanhouttei.

spireaella, Aphis Schouteden, 1903. Ann. Soc. Ent. Belg., XLVII, p. 194.
New name for **Aphis spiraeae** Schouteden, name pre-occupied.
Spiraea prunifolia, S. salicifolia, S. ulmaria, S. vanhouttei.

spiraephila, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 270, fig.
Spiraea salicifolia.

splendens, Siphocoryne Theobald, 1915. Bul. Ent. Research, VI, p. 116, fig.
Triticum vulgare.

spondylii, Hyalopterus Koch, 1854. Die Pflanzenläuse Aphiden, p. 17, fig.
Heracleum spondylium.

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spyrothecae, Pemphigus Passerini, 1860. Gli Afidi, p. 39.
Populus nigra, P. pyramidalis.

spyrothecae, Pemphigus Passerini, var. **infaustus** Ferrari, 1772. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 235.
Populus sp.

squamosa, Geoica Hart, 1894. Eighteenth Rept. Nox. & Ben. Insects Ill., p. 98, fig.
Avena sativa, Capsella bursa-pastoris, Echinochloa crus-galli, Phleum pratense, Poe annua, P. pratensis, Trifolium sp., Zea Mays.

squarrosa, Macrosiphum Sanborn, 1904. Kansas Aphididae, p. 77.
Actinomeris squarrosa.

stamineus, Aphis (Pemphigus) Haldeman, 1859. Proc. Boston, Soc. Nat. Hist., VI, p. 403.
Acer saccharinum.

stanleyi, Macrosiphum Wilson, 1915. Proc. British Columbia Ent. Soc., No. 5, p. 82, fig.
Sambucus glauca.

staphyleae, Rhopalosiphum Koch, 1854. Die Pflanzenläuse Aphiden, p. 32, fig.
Cystopteris montana?, Heliotropium peruvianum, Staphylea pinnata.

steinheili, Pterocomma Mordwilko, 1901. Horae Soc. Ent. Ross., XXXIII, p. 350. **Cladobius.**
Populus sp., Salix alba.

***stellariae, Brachycolus** (Hardy), 1850. North British Agriculturist, II, p. 788. **Aphis.**
Agrostis alba, A. vulgaris, Cerastium triviale, Fastuca ovina, Holcus lanatus, H. mollis, Stellaria graminea, S. holostea, S. media, Triticum sp.

stellariae, Macrosiphum Theobald, 1912. The Trans. Second Ent. Congress, p. 387; also 1913, Jour. Econ. Biol. VIII, No. 3, p. 141.
Stellaria graminea.

stevensis, Chaitophorus Sanborn, 1904. Kansas Aphididae, p. 36.
Populus deltoides, P. monilifera.

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stigma, Schizoneura Curtis, 1844. Gardners Chronicle, IV, p. 37. "Fir trees"?

***strobi, Chermes** (Hartig), 1837. Jahrest. Forst. und Forsth. Naturk. im Jahre 1836, and 1837, pp. 643–648. **Coccus.**
Picea alba, Pinus strobus.

strobi, Lachnus (Fitch) 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist., p. 69. **Eriosoma.**
Pinus strobus.

strobilobius, Chermes Kaltenbach, 1843. Mon der Pflanzenläuse, p. 203.
Abies balsamea, A. pectinata, Larix decidua, L. laricina, Picea alba, P. abies, P. canadensis, P. englemanni, P. mariana, P. orientalis, P. pungens, Pinus sylvestris.

strobilobius, Chermes Kaltenbach. var. **tradoides** Cholodkovsky, 1915. Dept. of Agr. Central Board of Land Admins. & Agri., Petrograd., p. 57, fig.
Larix sp.

styracophila, Astegopteryx Karsch, 1890. Ber. Deut. Bot. Ges., VIII, part 2, p. 52, fig.
Styrax benzoin.

subelliptica, Phylloxera (Shimer), 1869. Trans. Amer. Ent. Soc., II, p. 389. **Dactylosphaera.**
Carya sp.

suberi, Tavaresiella Del Guercio, 1911. Redia, VII, p. 299, fig.
Quercus suber.

submacula, Aphis Walker, 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 104.
Food plant unknown.

subterranea, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1033.
Dianthus plumarius, Pastinaca sativa.

subterranea, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 155, fig. **Siphonophora.**
Senecio jacobaea.

subterraneus, Lachnus Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir., II, p. 109.
Lycopersicum esculentum.

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subterraneus, Rhizobius Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 209.
Tsuga canadensis.

subterrans, Amphorophora Wilson, 1915. Trans. Amer. Ent. Soc., XLI, p. 99, fig.
Dactylis glomerata.

suffragans, Aphis Walker, 1848. The Zool. VI, p. 2221.
Lycopsis arvensis.

superabilis, Aphis Walker, 1852. List. Homop. Insects Brit. Museum, part 4, p. 1039.
No food plant given.

swezeyi, Aphis Fullaway, 1910. Rept. Hawaii Agr. Exp. Sta., (1909), p. 36, fig.
Gnaphalium sp.

symmetrica, Phylloxera Pergande, 1904. Proc. Dav. Acad. Sci., IX, p. 230.
Carya alba.

symmetrica, Phylloxera var. purpurea Pergande, 1904. Proc. Daven. Acad. Sci., IX, p. 233.
Carya alba.

symmetrica, Phylloxera var. vasculosa Pergande, 1904. Proc. Daven. Acad. Sci., IX, p. 233.
Carya alba.

symphiti, Aphis Schrank, 1801. Fauna Boica, II, p. 107.
Achillea millefolum, Anchusa italica, Arctium lappa, Capsella bursa-pastoris, Carduus anchanthoides, C. crispus, C. nutans, Circium lanceolatum, Citrullus vulgaris, Cucurbita clypciformis, C. maxima, C. pepo, Cynoglossum officinale, Echinospermum lappula, Echium vulgare, Galeopsis ladanum, Myosotis palustris, M. sylvatica, Onopordon achantium, Stacyhs recta, Symphitum officinale.

symphoricarpi, Aphis Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 12.
Symphoricarpos occidentalis, S. orbiculatus, S. racemosa.

tabaci, Macrosiphum (Pergande), 1898. Can Ent. XXX, p. 300. Nectarophora.
Chrysanthemum leucanthemum, Forsythia viridissima, Lycopersicum esculentum, Nicotiana tabacum, Pyrus communis, P. malus, Rumex crispus, Solanum melongena.

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tabaci, Myzodes Mordwilko, 1914. Fauna of Russia (Insecta Hemiptera), I, Petrograd., p. 52.
Food plant?

taeniatoides, Lachnus Mordwilko, 1901. Horae Ent. Soc. XXXIII, p. 422.
Pinus strobus.

taeniatus, Lachnus Koch, 1857. Die Pflanzenläuse Aphiden, p. 240, fig.
Pinus cembra, P. "maritima," P. sylvestirs.

tahoense, Cryptosiphum Davidson, 1911. Jour. Econ. Ent. IV, p. 559.
Arctostaphylos pumilla, A. tomentosa.

tamaricis, Aphis Lichtenstein, 1885. Bul. Ent. Soc. France, (6), V, p. 179.
"Tamarix."

tanacetaria, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 19. Aphis.
Artemisia absinthium, A. vulgare, Chrysanthemum sp., Tanacetum vulgare.

tanaceti, Myzus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. Aphis. Not described until 1761. Fauna Seucica, p. 260.
Lapsana communis, Tanacetum vulgaris.

tanaceticola, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 33. Aphis.
Achillea millefolium, Tanacetum vulgare.

tanacetina, Aphis Walker, 1850. Ann. Mag. Nat. Hist. ser. 2, VI, p. 46.
Tanacetum vulgare.

taraxaci, Macrosiphum (Kaltenbach), 1843. Mon. der Pflanzenläuse, p. 30. Aphis.
Taraxacum officinale, Leontodon taraxaci.

***tardus, Chermes** (Dreyfus), 1889. Tag. Deut. Nat. Vers 51, Koln. 19 Sept. (1). Adelges.
For host plants see **Chermes strobilobius** Kaltenbach; thought to be a variety of **Chermes lapponicus** Cholodkovsky.
Larix decidua, Picea abies.

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targionii, Myzus Del Guercio, 1894. IL Nat. Sci. XIII, p. 197.
Cistus sp., Lippia citriodora, Pelargonium sp.

tavaresi, Aphis Del Guercio, 1908. Broteria VII, p. 143, fig.
Citrus aurantium, C. medica, Gossypium sp.

taxi, Chermes Buckton, 1886. Trans Ent. Soc. London, p. 327, fig.
Taxus baccata.

tentans, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1045.
Mentha aquatica.

tenuicorpis, Trichosiphum Okajima, 1908. Bul. Coll. Agr. Tokyo Imp. Univ. VIII, No. 1, p. 22.
Quercus cuspidata.

tenuinervis, Aphis Zetterstedt, 1840. Insecta Lappnica, p. 312.
"Hab. in paroecia Lapponiae Fedrica var.; d. 29 Jul. a me capta."

tenuior, Aphis Walker, 1849. The Zool. VII, p. 49, app.
Larix communis, L. decidua.

terricola, Aphis Rondani, 1847. Nuov. Ann. Sci. Nat. Rend. (Bologna) ser. 2, VIII, p. 344.
Centaurea scabiosa, C. solstitialis, Cirsium arvense, Picris echioides, P. hieracioides, Sonchus oleraceus.

tertia, Aphis Walker, 1849. The Zool. VII, p. 45, app.
Urtica dioica.

tessellata, Prociphilus (Fitch), 1851. Rept. Reg. Univ. State N. Y. Cab. Nat. Hist. p. 68. **Eriosoma.**
Acer saccharinum, A. saccharum, Alnus incana, A. rhombifolia, A. rubra, A. rugosa, Betula sp.

***testudinatus, Phyllophorus** Thornton, 1852. Trans. Mic. Soc. London, III, p. ?
Acer Pseudo-platanus.

***testudo, Periphyllus** Van Der Hoeven, 1863. Tidjscher, Ent. Ned. Ent. Ver., VI, pp. 1—7, fig.
Acer campestris.

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tetrapteralis, Aphis Cockerell, 1902. Bul. S. Cal. Ac. Sci., I, p. 40.
Atriplex canescens.

tetrarhoda, Myzus (Walker), 1849. Ann. Mag. Nat. Hist., (2), IV, p. 42. **Aphis.**
Corylus avellana, Hieracium pilosella, Rosa canina, R. centifolia, R. gallica.

teucrii, Aphis Lichtenstein, 1884. La Flore des aphidens, p. 52. No description.
Teucrium sp.

thalictri, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 81, fig.
Thalictrum aquilegiifolium, T. minus.

thalictri, Myzus Williams, 1911. Aphididae of Nebraska, p. 68.
Thalictrum revolutum.

thaspii, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 58.
Thaspium aureum.

theaccola, Myzus Buckton, 1891. Ind. Mus. Notes, II, p 33. **Ceylonia.**
Camellia thea, Theobroma cacoa.

theobaldii, Macrosiphum Davis, 1915. U. S. Dept. Agr. Bul. 276, p. 4. A new name for **Macrosiphum trifolii** Theobald.
Trifolium procumbens.

theobromae, Toxoptera Schouteden, 1906. Ann. Soc. Ent. Belg., L. p. 38.
Theobroma cacoa.

thlaspeos, Aphis Schrank, 1801. Fauna Boica, II. p. 118.
Papaver sp., Thlaspi sp.?

thujafolia, Lachniella Theobald, 1914. Bul. Ent. Research, IV, p. 335, fig.
Thuja orientalis.

tiliae, Drepanosiphum Koch, 1855. Die Pflanzenläuse Aphiden, p. 204, fig.
Populus nigra, P. pyramidalis, Tilia americana, T. grandifolia, T. platyphyllos.

tiliae, Eucallipterus (Linnaeus), 1758. Edition 10, Systema Naturae, p. 452. **Aphis.**
Tilia americana, T. cordata, T. platyphyllos, T. rubra, T. vulgaris.

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tiliae, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 20. **Siphonophora.**
Tilia americana.

tincta, Aphis Walker, 1849. The Zool. VII, p. 51, app.
Epilobium sp.

tomentosus, Lachnus (Villers), 1789. Linaei Entomologia Faunae Suecicae, I, p. 549. **Aphis.**

tormentilliae, Aphis Passerini, 1879. Bul. Soc. Ent. Ital., XI, p. 48.
Potentilla tormentilla.

torticauda, Aphis Gillette, 1907. Can. Ent., XXXIX, p. 389, fig.
Carduus sp.

tortuosus, Pemphigus Rudow, 1875. Zeit. Ges Natur., (2), XII, p. 248.
Populus nigra.

tradoides, Chermes Cholodkovsky as a var. of C. **strobilobius** Kaltenbach which see.

tragopogonis, Aphis Kaltenbach, 1843. Mon der Pflanzenläuse, p. 124.
Tragopogon dubius, T. porrifolius, T. pratensis.

transiens, Aphis Walker, 1849. The Zool. VII, p. 44, app.
Polygonum persicaria.

translata, Aphis Walker, 1849. The Zool. VII, p. 35, app.
Ononis spinosa.

transmutata, Aphis Walker, 1849. The Zool. VII, p. 37, app.
Prunus spinosa.

transposita, Aphis Walker, 1849. The Zool. VII, p. 37, app.
Prunus domestica.

tremulae, Asiphum Linnaeus, 1761. Fauna Suecica, p. 261. **Aphis.**
Populus alba, P. pyramidalis, P. tremula.

tremulae, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 8, fig.
Populus tremula.

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tribulis, Aphis Walker, 1849. The Zool. VII, p. 34, app.
Vicia sepium.

tricolor, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 9, fig.
Betula alba, B. nigra.

tridentatae, Aphis Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p, 94, fig.
Artemisia tridentata.

tridentatae, Chaitophorus Wilson, 1915. Trans. Amer. Ent. Soc. XLI, p. 89, fig.
Artemisia tridentata.

trifolii, Aphis Oestlund, 1887. Aphididae of Minnesota, p. 55.
Trifolium pratense, T. repens.

trifolii, Macrosiphum Pergande, 1904. U. S. Bureau of Entomology, Bul. 44, p. 21.
Avena sativa, Fragaria sp., Sonchus oleraceus, Taraxacum officinale, Trifolium pratense, Triticum vulgare.

trifolii, Macrosiphum Theobald, 1912. Tran. Second Ent. Congress, p. 384, also 1913, Jour. Econ. Biology, VIII, No. 3, p. 139.
Trifolium procumbens.

trifolii, Myzocallis (Monell), 1882, Can Ent. XIV, p. 14. **Callipterus.**
Trifolium pratense, T. repens.

triphaga, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1041.
Epilobium sp.

trirhoda, Hyalopterus (Walker), 1849. Ann. Mag. Nat. Hist., (2), IV, p. 45. **Aphis.**
Aquilegia vulgaris, Rosa canina, R. gallica, Rubus ulmifolius.

tritici, Brachycolus Gillette, 1911. Ent. News, XXII, p. 441, fig.
Agropyron glaucum, A. occidentale, Bromus secalinus, Phleum pratense, Stipa comata, Triticum vulgare.

trivialis, Tychea Passerini, 1860. Gli Afidi, p. 40.
Agropyron repens, Bromus arvensis, B. mollis, B. sterilis, Cynodon dactylon, Digitaria filiformis, Festuca elatior, F. ovina-duriuscula, Poa annua, P. pratensis, P. trivialis, Setaria sp., Triticum spelta, T. vulgare.

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troglodytes, Trama Heyden, 1837. Ent. Beitr. Mus. Senk., II, p. 293.
Achillea millefolium, Centaurea jacea, Cichorium endiva, C. intybus, Cirsium arvense, Crepis biennis, Cynara cardunculus, Cytisus scoparius, Hieracium pilosella, Lactuca scariola, Leontondon sp., Onopordon acantium, Silybum marianum, Sonchus arvensis, S. asper, S. oleraceus, Taraxacum officinale.

tropicalis, Pterochlorus Van Der Goot, 1916. Indian Museum Notes, XII, p. 3, fig.
Food plant unknown.

443.

truncata, Aphis Hausmann, 1802. Illigers Insekten Kunde, I, p. *Salix caprea.*

tuberculata, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 233, p. 261, fig.
Prunus serotina.

tuberculata, Callipterus (Heyden), 1837. Ent. Beitr. Mus. Senk., II, p. 296. Aphis.
Betula alba, B. nigra.

tuberculostemmata, Protolachnus Theobald, 1915. Bul. Ent. Research, VI, p. 145, fig.
Pinus sp.

tuberosae, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 180.
Cynoglossum sp., Cyperis laevigatus, Funkia subcordata, Polianthus tuberosa.

tujae, Lachniella Del Guercio, 1909. Redia, V. p. 309, fig.
"Tuja" occidentalis.

tujafilina, Lachniella Del Guercio, 1909. Redia, V. p. 311, fig.
"Tuja" occidentalis.

tulipae, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 167.
"Chonodoxia" sp., Tulipa sp.

tulipae, Macrosiphum (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 19. Siphonophora.
Tulipa gesneriana.

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tulipae, Rhopalosiphum Thomas, 1879. Eighth Rept. State Ent. Ill., p. 80.
Liriodendron tulipifera, Tulipa gesneriana.

tulipaella, Rhopalosiphum Theobald, 1916. The Entomologist, XLIX, p. 146, fig.
Tulips and violets.

tuligreni, Hamamelistes Meijere, 1912. Zeitschr. wiss. Insektbiol. VIII, p. 91.
Betula alba.

turanicum, Acyrthosiphon Mordwilko as a sub sp. of **M. pisi** Kaltenbach, which see.

turbida, Schizoneura Walker, 1852. List Homop. Insects Brit. Museum part 4, p. 1051.
No food plant given.

tussilaginis, Macrosiphum (Walker), 1850. Ann. Mag. Nat. Hist., (2), V, p. 390. **Aphis.**
Tussilago farfara.

tussilaginis, Macrosiphum (Koch), 1855. Die Pflanzenläuse Aphiden, p. 158, fig. **Siphonophora.**
Tussilago farfara.

ulmariae, Macrosiphum (Schrank), 1801. Fauna Boica, II, p. 116. **Aphis.**
Anthriscus sylvestris, A. vulgaris Artemisia campestris, Beta vulgaris, Capsella bursa-pastoris, Chaerophyllum sylvestris, C. tremulum, Colutea arborescens, Cytisus scoparius, Epilobium montanum, Genista tinctoria, Geum urbanum, Gratiola officinalis, Hyoseris radiata, Lactuca sativa, Lathyrus latifolius, L. odoratus, L. pratensis, Lotus uliginosus, Medicago orbicularis, M. sativa, Onobrychis viciaefolia, Ononis repens, O. spinosa, Phaseolus sp., Pisum arvense, P. sativum, Robinia pseudo-acacia, Rosa sp., Spartium junceum, S. scoparum, Spirea ulmaria, Tanacetum vulgare, Tragopogon pratensis, Trifolium filaforme, T. pratense, T. repens, Urtica dioica, U. holsericea, Vicia angustifolia, V. cracca, V. gigantea, V. ludoviciana, V. sativa, V. sepium, V. villosa.

ulmi, Eriosoma Riley, 1869. First Rept. Nox & Ben. Insects. Mo., p. 124.
Ulmus americana.

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ulmi, Georgia Wilson, 1911. Can Ent., XLIII, p. 64.
Ulmus sp.

***ulmi, Pemphigus** Lichtenstein, 1879. Feuill. Jeun. Nat., IX, p. 9.
Alnus sp.

ulmi, Schizoneura (Linnaeus), 1758. Edition 10, Systema Naturae, p. 453. **Chermes.**
Ribes grossularia, R. nigrum, Ulmus americana, U. campestris, U. effusa.

ulmi, Tetraneura (Linnaeus), 1758. Edition 10, Systema Naturae, p. 451. **Aphis.**
Avena sativa, Crataegus oxyacantha, Cynodon dactylon, Deschampsia caespitosa, D. flexuosa, Digitaria sanguinalis, Echinochloa crus-galli, Eragrostis megastachya, Lolium perenne, Oryza sativa, Pistacia terebinthus, Sorghum halepense, S. saccharatum, S. vulgare, Ulmus americana, U. campestris, U. "effusa," U. montana, Zea mays.

ulmicola, Colopha (Fitch), 1859. Fifth Rept. Nox. & Ben. Ins., N. Y., p. 843. **Byrsocrypta.**
Eragrostis megastachya, Panicum sp., Ulmus americana, U. racemosa.

ulmicola, Myzocallis (Thomas), 1879. Eighth Rept. State Ent. Ill., p. 111. **Callipterus.**
Ulmus americana.

ulmifolii, Myzocallis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv., Terr. V, No. 1, p. 29. **Callipterus.**
Triticum vulgare, Ulmus americana.

ulmi-fusus, Pemphigus Walsh & Riley, 1869. American Entomologist, I, p. 109.
Ulmus fulva.

ulmisacculi, Tetraneura Patch, 1910. Maine Agr. Exp. Sta., Bul. 181, p. 216, fig.
Ulmus montana var. *Camperdown pendula.*

umbellatarum, Aphis Koch, 1854. Die Pflanzenläuse Aphiden, p. 116, fig.
Daucus carota?

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umbellulariae, Hyadaphis Davidson, 1911. Jour. Econ. Ent., IV, p. 559.
Umbellularia californica.

urticae, Aphis Fabricius, 1775. Systema Entomologiae, p. 738.
Althaea sp., Malopa trimestri, Malva sylvestris, Parietaria judaica, P. officinalis, Rubus caesius, R. fructicosus, R. idaeus, Stachys recta, S. sylvatica, Urtica dioica, U. urens, Clematis vitalba.

urticae, Aphis Linnaeus, 1758. Edition 10, Systema Naturae, p. 453.
Clematis vitalba?, Urtica sp.

urticae, Acyrthosiphon (Microlophium), (Schrank), sub. sp. **meridionale,** Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd., p. 218.
Urtica dioica.

urticae, Acyrthosiphon (Microlophium) Schrank sub sp. **urticae,** Mordwilko, 1914. Fauna of Russia, (Insecta Hemiptera), I, Petrograd. p. 202.
Urtica dioica.

urticae, Macrosiphum (Schrank), 1801. Fauna Boica, II, p. 106. **Aphis.**
Chelidonium majus, Cineraria sp., Geranium robertianum, Malva moschata, M. sylvestris, Urtica dioica, U. urens.

urticaria, Aphis Kaltenbach, 1843. Mon. der Pflanzenläuse, p. 57.
Parietaria effusa, P. officinalis, Ribes grossularia, Rubus fructicosus, R. idaeus, Stachys sylvatica, Urtica dioica, U. urens.

ussuriensis, Acyrthosiphon Mordwilko, as a sub sp. of **M. Pisi** Kaltenbach, which see.

***utricularius, Pemphigus** Passerini, 1856. Giornale Giardini, III, p. 260.
Pistacia terrebinthus.

vacca, Rhizoterus Hartig, 1841. Zeit. Ent. (Germar), III, p. 363.
Zea mays?

vacillans, Aphis Walker, 1849. The Zool. VII, p. 47, app.
Tussilago farfara.

vagabunda, Mordwilkoja (Walsh), 1862. Proc. Ent. Soc. Phil. I, p. 306. **Byrsocrypta.**
Populus balsamifera, P. deltoides, P. monilifera, Smilax sp.

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vagans, Schizoneura Koch, 1857. Die Pflanzenläuse Aphiden, p. 268, fig.
Prunus sp.?

valerianae, Aphis Cowen, 1895. Hemiptera of Colorado., p. 121.
Valeriana edulis.

valerianiae, Macrosiphum (Clarke), 1903. Can. Ent., XXXV, p. 253. **Nectarophora.**
Valeriana officinalis.

valerianina, Aphis Del Guercio, 1911. Redia, VII, p. 322.
Valeriana sp.

valida, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1033.
No food plant given.

variabilis, Microparsus Patch, 1909. Ent. News, XX, p. 338, fig.
Desmodium canadense, D. canescens, D. marylandicum.

varians, Aphis Patch, 1914. Me. Agr. Exp. Sta. Bul. No. 225, p. 56.
Ribes sp.

varians, Myzus Davidson, 1912. Jour. Econ. Ent. V, p. 409, fig.
Clematis ligusticifolia.

variegata, Toxoptera Del Guercio, 1909. Rivista di Pat. Veget. IV, p. 8.
Rhamnus alaternus.

varsoviensis, Pemphigus Mordwilko, 1895. Rab. Lab. Zool. Kab. Varch. Univ., p. 183.
Populus sp.

vasculosa, Phylloxera Pergande, as a var. of **P. symmetrica** Pergande, which see.

vastator, Rhopalosiphum (Smee), 1846. The Potato Plant, p. 63, fig. (Buckton). **Aphis.**
Solanum tuberosum.

vastatrix, Phylloxera Planchon, 1868. Compt. Rend. Acad. Sci., Paris, LXXIV, p. 588, Sept. 14.
Vitis vinifera.

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venaefuscae, Macrosiphum Davis, 1914. Can. Ent. XLVI, p. 77, fig.
Polygonum cristatum, Rumex crispus.

venafuscus, Prociphilus (Patch) 1909. Ent. News, XX, p. 319, fig. **Pemphigus.**
Fraxinus pennsylvanicum, Syringa vulgaris, Ulmus americana.

venusta, Schizoneura Passerini, 1860. Gli Afidi, p. 38.
Bromus arenarius, B. unioloides, Cynodon dactylon, Digitaria humifusa, Eragrostis megastachya, Hierochloae australis, Lolium perenne, L. temulentum, Panicum miliaceum, Poa sp., Setaria glauca, S. italica, S. verticellata, S. viridis, Triticum vulgare, Zea mays.

veratri, Aphis Walker, 1852. List Homop. Insects Brit. Museum, part 4, p. 1041.
Veratrum album.

veratri, Aphis Cowen, 1895. Hemiptera of Colorado, p. 122.
Veratrum californicum.

verbasci, Aphis Schrank, 1801. Fauna Boica, II, p. 107.
Verbascum nigrum, V. phlomoides, V. sinuatum, V. thapsus.

verbasci, Aphis Boyer de Fonscolombe, 1841. Ann. Soc. Ent. France, X, p. 181.
Verbascum nigrum.

verbenae, Aphis Macchiati, 1883. Bul. Soc. Ent. Ital., XV, p. 258.
Verbena chamaedryfolia.

verbenae, Macrosiphum (Thomas), 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 8. **Siphonophora.**
Verbena officinalis.

verbena-hastata, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev. III, p. 17.
Verbena hastata.

vernoniae, Aphis Thomas, 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 10.
Vernonia fasciculata.

veronicae, Aphis Walker, 1848. The Zool. VI, p. 2248.
Veronica chamaedrys.

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veronicae, Macrosiphum Theobald, 1913. Jour. Econ. Biol., VIII, No. 2, p. 93.
Veronica beccabunga.

veronicae, Myzus Del Guercio, 1900. Nuov. Relaz. Staz. Agr. Fir., II, p. 151.
Veronica sp.

versicolor, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 10, fig.

verticolor, Aphis Rafinesque, 1817 Amer. Mon. Mag. & Critic. Rev. I, p. 361.
"Cichoracerus," "Glossanthia," Hieracium venosum.

viridescens, Lachnus Cholodkovsky, as a var. of **L. piceicola** Cholodkovsky, which see.

vesicalis, Pachypappa Koch, 1857. Die Pflanzenläuse Aphiden, p. 272, fig.
Populus alba, P. nigra, P. tremula.

vesicalis, Stagona Rudow, 1875. Zeit. Ges. Naturv. n. s., XII, Mecklenburg, pp. 248–249.
Populus balsamifera, P. nigra, P. tremula.

vesicarius, Pemphigus Passerini, 1861. Atti della Soc. Ital. Sci. Nat. III, p. 401.
Populus nigra.

viburni, Aphis Scopoli, 1763. Entomologia Carniolica, p. 136.
Actaea alba, Philadelphus coronarius, Valeriana officinalis, Viburnum latana, V. opulus.

viburni, Aphis Fabricius, 1775. Systema Entomologiae, p. 737.
Viburnum opulus.

viburnicola, Aphis Gillette, 1909. Ent. News, XX, p. 280, fig.
Viburnum opulus.

viburnum-acerifolium, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Viburnum acerifolium, V. opulus.

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viburnum-opulus, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 16.
Viburnum opulus.

viciae, Aphis Fabricius, 1781. Species Insectorum, II, p. 390.
Vicia cracca.
Fabricius refers this species to Linnaeus but Linnaeus was not the first to give this species after 1758.

viciae, Macrosiphum (Kaltenbach), 1843 Mon. der Pflanzenläuse, p 20. **Aphis.**
Lathyrus latifolius, L. pratensis, L. sylestris, Vicia angustifolia, V. faba, V. sativa, V. sepium.

viciae, Megoura Buckton, 1876. Mon. Brit. Aphides, I, p. 188, fig.
Lathyrus sp., Vicia sepium.

villosus, Aphis Hartig, 1841. Zeit Ent. (Germar) III, p. 369.
Acer sp.

viminalis, Aphis Hartig, 1841. Zeit Ent. (Germar) III, p. 369.
Food plant not given.

viminalis, Chaitophorus Monell, 1879. Bul. U. S. Geol. & Geog. Terr. Surv. V, No. 1, p. 31.
Salix alba, S. babylonica, S. cordata, S. lucida, S. viminalis.

viminalis, Lachnus (Boyer de Fonscolombe), 1841. Ann. Soc. Ent. France, X, p. 184. **Aphis.**
Populus nigra, Pyrus malus, Salix alba, S. caprea, S. cinerea, S. daphnoides, S. fragilis, S. purpurea, S. viminalis.

vincae, Macrosiphum (Walker), 1848. Ann. Mag. Nat. Hist. ser. 2, II, p. 429. **Aphis.**
Vicia faba, Vinca major, Calystegia sp.

vincae, Myzus Gillette, 1908. Can Ent. XL, p. 19, fig.
Vinca sp. (In greenhoues.)

violae, Aphis Schouteden, 1900. Ann. Ent. Soc., Belg., LXIV, p. 127.
Viola tricolor.

violae, Neotoxoptera Theobald, 1915. Bul. Ent. Research, VI, p. 131, fig.
Viola sp.

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violae, Rhopalosiphum Pergande, 1900. Can. Ent. XXXII, p. 29.
Viola odorata.

violae, Rhopalosiphum Essig, 1909. Pomona Coll. Jour. Ent., I, p. 4. *Misprint, Essig for Pergande.*
Viola odorata.

virgata, Aphis Del Guercio, 1911. Redia, VII, p. 316, fig.
Epilobium virgatum.

viridana, Forda Buckton, 1883. Mon. Brit. Aphides, IV, p. 85, fig.
Deschampsia flexuosa.

viridanus, Chermes Cholodkovsky, 1896. Zool. Anz., XIX, p. 39.
Larix decidua, L. sibirica, Picea abies, P. alba, P. obovata.

viridis, Chermes Ratzeburg, 1843. Stett. Ent. Zeit., p. 202.
Larix sp., Picea sp., Pinus sp.

viridis, Chermes Ratzeburg, var. **lutescens** Cholodkovsky, 1915. Dept. of Agr. Central Board of Land Adminis. & Agr., Petrograd., p. 15, fig.
Larix decidua, Picea excelsa.

viridis, Chermes Ratzeburg, var. **viridis** Cholodkovsky, 1915. Dept. of Ag. Central Board of Land Adminis. & Agr., Petrograd., p. 15, fig.
Larix sp.

viridis, Rhizobius Theobald, 1915. The Entomologist, p. 154.
Picea sitchensis.

viridulus, Chermes Cholodkovsky, 1911. Zool. Anz., XXXVII, p. 175.
Larix sibirica.

vitalbae, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, III, p. 225.
Clematis recta, C. vitalba.

vitellinae, Aphis. Hartig, 1841. Zeit. Ent. (Germar) III, p. 369.
Food plant not given.

vitellinae, Chaitophorus (Schrank), 1801. Fauna Boica, II, p. 103. **Aphis.**
Salix alba, S. babylonica, S. fragilis, S. triandra.

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viticis, Aphis Ferrari, 1872. Ann. Mus. Civ. Stor. Nat. Genova, II, p. 67.
Vitex agnus-casti.

viticola, Aphis (Thomas), 1877. Ill. State Lab. Nat. Hist., Bul. 2, p. 5. **Siphonophora.**
Vitis vinifera, V. vulpina.

vitifoliae, Phylloxera (Fitch), 1855 First Rept. Nox. & Ben. Insects N. Y., p. 158. **Pemphigus.**
Vitis cordifolia, V. vinifera, V. vulpina.

vitis, Aphis Scopoli, 1763. Entomologia Carniolica, p. 137.
Vitis vinifera, V. vulpina.

vitisana, Peritymbia Westwood, 1869. Gardners Chronicle, p. 109.
Vitis vinifera.

vulgaris, Rhopalosiphum (Kyber), 1815. Germars Mag. Ent. I, p. 9. **Aphis.**
Food plant?

vulpiae, Aphis Del Guercio, 1913. Redia, IX, p. 207, fig.
Vulpa sp.

walshii, Myzocallis (Monell), 1879. Bul. U. S. Geol. & Geog. Surv. Terr. V, No. 1, p. 29. **Callipterus.**
Quercus rubra.

walshii, Pemphigus Williams, 1911. Aphididae of Nebraska, p. 15.
Ulmus americana.

whitei, Myzus Theobald, 1912. Jour. Econ. Biol. VII, p. 110, fig.
Ribes sp.

willcocksi, Anoecia Theobald, 1915. Bul. Ent. Research, VI, p. 141, fig.
Poa sp.

xanthelis, Aphis Rafinesque, 1818. Amer. Mon. Mag. & Critic. Rev., III, p. 17.
Solidago nemoralis.

xanthii, Anuraphis Del Guercio, 1913. Redia, IX; p. 156, fig.
Xanthium sp.

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xanthii, Siphocoryne Oestlund, 1886. Aphididae of Minnesota, p. 36.
Xanthium canadense.

xanthomelas, Chaitophorus Koch, 1854. Die Pflanzenläuse Aphiden, p. 1, fig.
Lycium europaeum.

xylostei, Prociphilus (DeGeer), 1773. Mems. des Insects, III, p. 96, fig. **Aphis.**
Lonicera xylosteum, Picea sp.

xylostei, Siphocoryne (Schrank), 1801. Fauna Boica, II, p. 107. **Aphis.**
Conium maculatum, Lonicera caprifolium, L. japonica, L. periclemunum, L. xylosteum.

yuccae, Aphis Cowen, 1895. Hemiptera of Colorado, p. 122.
Yucca glauca.

yuccae, Aphis Lichtenstein, 1884. La Flore des Aphidens, p. 55. No description.
Yucca sp.

yuccicola, Aphis Williams, 1911. Aphididae of Nebraska, p. 61.
Yucca glauca.

zeae, Aphis Bonafous, 1835. Ann. Soc. Ent. France, IV, p. 658.
Zea mays.

zeae, Aphis Curtis, 1842. Gardners Chronicle, II, p. 4 fig.
Zea mays.

zehntneri, Ceratopemphigus Schouteden, 1905. Spolia zeylanica, II, p. 187, fig.
Pistacia atlantica.

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PART II

A LIST OF APHID FOOD PLANTS AND THE APHIDS SAID TO ATTACK THEM

Abies sp.
Aphis abietaria Walker.
Aphis gallarum DeGeer.
Lachnus costata Zetterstedt.
Lachnus fasciatus Burmeister.
Prociphilus nidificus Low.
Schizoneura costata Hartig.

Abies balsamea.
Chermes coccineus Ratzeburg.
Chermes pectinatae Cholodkovsky.
Chermes strobilobius Kaltenbach.
Lachnus curvipes Patch.
Prociphilus bumeliae Schrank.
Prociphilus poschingeri Holzner.
Schizoneura obliqua Cholodkovsky.

Abies cilicica.
Lachniella cilicica Del Guercio.

Abies concolor.
Lachnus abietis Fitch.
Schizoneura obliqua Cholodkovsky.

Abies fraseri.
Prociphilus bumeliae Schrank.
Prociphilus poschingeri Holzner.

Abies grandis.
Lachnus occidentalis Davidson.

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Abies nobilis.
Chermes piceae bouveri Cholodkovsky.
Dreyfusia nüsslini Börner.

Abies nordmanniana.
Dreyfusia nüsslini Börner.
Mindarus abietinus Koch.

Abies pectinata.
Chermes coccineus Ratzeburg.
Chermes pectinatae Cholodkovsky.
Chermes piceae Ratzeburg.
Chermes strobilobius Kaltenbach.
Dreyfusia nüsslini Börner.
Eulachnus macchiatii Del Guercio.
Lachnus pichtae Mordwilko.
Mindarus abietinus Koch.

Abis sibirica.
Chermes pectinatae Cholodkovsky.
Chermes pini Koch.
Lachnus abieticola Cholodkovsky.
Lachnus abietis Fitch.

Abies veitchii.
Prociphilus bumeliae Schrank.

Abies webbiana.
Chermes abietis-piceae Stebbing.
Chermes himalayensis Stebbing.

Acaena splendens.
Myzus michaelseni Schouteden.
Rhopalosiphum acaenae Schouteden.

Acalypha virginica.
Aphis gossypii Glover.

Acanthaceae.
Aphis nerii Kaltenbach.

Acer sp.
Aphis villosus Hartig.

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Acer campestre.
Aphis longirostris Fabricius.
Aphis perforatus Signoret.
Chaitophorus aceris Linnaeus.
Chaitophorus betulae Buckton.
Chaitophorus coracinus Koch.
Chaitophorus granulatus Koch.
Chaitophorus lyropictus Kessler.
Drepanosiphum acerina Walker.
Drepanosiphum aceris Koch.
Drepanosiphum plantanoides Schrank.
Stomaphis graffi Cholodkovsky.

Acer menspessulanum.
Chaitophorus aceris Linnaeus.

Acer negundo=Negundo aceroides.
Aphis longirostris Fabricius.
Chaitophorus aceris Linnaeus.
Chaitophorus negundinis Thomas.
Drepanosiphum braggii Gillette.
Rhopalosiphum persicae Sulzer.

Acer opulifolium.
Chaitophorus aceris Linnaeus.

Acer pennsylvanicum.
Chaitophorus aceris Linnaeus.

Acer platanoides.
Chaitophorus aceris Linnaeus.
Chaitophorus coracinus Koch.
Chaitophorus lyropictus Kessler.
Drepanosiphum acerina Walker.
Drepanosiphum platanoides Schrank.

Acer pseudo-platanus.
Aphis acericola Walker.
Chaitophorus aceris Linnaeus.
Chaitophorus coracinus Koch.
Drepanosiphum acerina Walker.
Drepanosiphum platanoides Schrank.
Myzus gracilis Buckton.
Phyllophorus testudinatus Thornton.

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Acer saccharinum.
Aphis quercifoliae Walsh.
Drepanaphis acerifoliae Thomas.
Longistigma caryae Harris.
Pemphigus acerifolii Riley.
Pemphigus stamineus Haldeman.
Prociphilus tessellata Fitch.

Acer succharum=A. saccharinum.
Drepanaphis acerifoliae Thomas.
Drepanaphis minutus Davis.
Pemphigus aceris Monell.
Prociphilus tesselata Fitch.
Pterocomma salicti Harris.

Acer tataricum.
Chaitophorus aceris Linnaeus.
Stomaphis grafti Cholodkovsky.

Acerates floridana=gomphocarpus longifolius.
Aphis asclepiadis Fitch.

achillea ageratum.
Macrosiphum millefolii DeGeer.
Pemphigus brevicornis Hart.

Achillea ligustica.
Aphis balsamitae Müller.
Aphis helichrysia Kaltenbach.
Macrosiphum absinthii Linnaeus.
Macrosiphum millefolii DeGeer.

Achillea millefolium.
Aphis balsamitae Müller.
Aphis dauci Fabricius.
Aphis helichrysi Kaltenbach.
Aphis plantaginis Schrank.
Aphis rumicis Linnaeus.
Aphis symphiti Schrank.
Macrosiphum absinthii Linnaeus.
Macrosiphum achilleae Fabricius.
Macrosiphum achilleae Koch.
Macrosiphum artemisiae Boyer.
Macrosiphum millefolii DeGeer.
Machosiphum sonchi Linnaeus.

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Macrosiphum tanaceticola Kaltenbach.
Pemphigus betae Doane.
Pemphigus brevicornis Hart.
Rhizobius sonchi Passerini.
Trama pubescens Koch.
Trama troglodytes Heyden.

Achillea nobilis.
Macrosiphum artemisiae Boyer.

Achillea odorata.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.

Achillea ptarmica.
Aphis balsamitae Müller.
Aphis dauci Fabricius.
Aphis helichrysi Kaltenbach.
Aphis rumicis Linnaeus.
Aphis plantaginis Schrank.
Macrosiphum milleforiae DeGeer.
Microsiphum ptarmicae Cholodkovsky.

Achyrantes sp.
Macrosiphum achyrantes Monell.
Rhopalosiphum persicae Sulzer.

Aconitum cammarum.
Myzus junackianus Karsch.

Aconitum lycoctonum.
Myzus junackianus Karsch.

Aconitum napellus.
Aphis napelli Schrank.
Rhopalosiphum aconiti Van Der Goot.

Aconitum uncinatum.
Aphis napelli Schrank.

Acorus calamus.
Cerataphis lataniae Boyer.
Siphocoryne nymphaeae Linnaeus.

Acrostichum reticulatum.
Idiopterus nephrelepidis Davis.
Macrosiphum kirkaldyi Fullaway.

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Actaea alba.
Aphis viburni Scopoli.

Actinomeris squarrosa.
Macrosiphum squarrosa Sanborn.

Adenostyles albida.
Aphis farfarae Koch.
Phorodon inulae Passerini.

Adiantum hybridum.
Macrosiphum circumflexa Buckton.

Adiantum pedatum.
Aphis adianti Oestlund.
Macrosiphum adianti Oestlund.

Aegopodium podagraria.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Siphocoryne aegopodii Scopoli.
Siphocoryne capreae Fabricius.

Aesculus glabra.
Drepanaphis monelli Davis.

Aesculus parviflora.
Chaitophorus aceris Linnaeus.

Aethusa cynapium.
Aphis heraclei Koch.
Aphis rumicis Linnaeus.

Agave sp.
Aphis sambuci Linnaeus.

Ageratum conizoides.
Aphis helichyrsi Kaltenbach.

Agrimonia eupatoria.
Macrosiphum agrimoniella Cockerell.

Agropyron glaucum.
Brachycolus tritici Gillette.
Chaitophorus agropyronensis Gillette.

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Agropyrom occidentale=A. smithii?
Brachycolus tritici Gillette.
Pemphigus betae Doane.
Toxoptera graminum Rondani.

Agropyron repens.
Forda formicaria Heyden.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.
Tychea triviolis Passerini.

Agropyron smithii.
Toxoptera graminum Rondani.

Agropyron tenerum.
Toxoptera graminum Rondani.

Agrostemma githago=Lychnis githago.
Macrosiphum agrostemnium Theobald.
Macrosiphum cichorii Koch.
Macrosiphum githago Theobald.
Macrosiphum picridis Fabricius.

Agrostis sp.
Sipha glyceriae italica Del Guercio.

Agrostis alba.
Aphis avenae Fabricius.
Brachycolus stellariae Hardy.
Macrosiphum cerealis Kaltenbach.

Agrostis vulgaris.
Brachycolus stellariae Hardy.

Ailanthus glandulosa.
Aphis pomi DeGeer.

Aira caryophyllea.
Sipha berlesei Del Guercio.

Ajuga genevensis.
Myzus ajugae Schouteden.

Ajuga reptans.
Myzus ajugae Schouteden.

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Alisma plantago.
Aphis abbreviata Patch.
Rhopalosiphum alismae Koch.
Siphocoryne nymphaeae Linnaeus.

Allium sp.
Aphis allii Lichtenstein.

Alnus sp.
Aphis punctipennis Zetterstedt.
Chermes alni Kalm.
Pemphigus alni Provancher.

Alnus glutinosa.
Aphis bifrons Walker.
Callipterus giganteus Cholodkovsky.
Callipterus maculata Hayden.
Glyphina alni Schrank.
Myzocallis alni DeGeer.
Myzocallis coryli Goeze.
Vacuna betulae Kaltenbach.

Alnus incana.
Callipterus giganteus Cholodkovsky.
Glyphina alni Schrank.
Prociphilus tessellata Fitch.

Alnus rhombifolia.
Euceraphis flavus Davidson.
Euceraphis gillettei Davidson.
Myzocallis alni DeGeer.
Prociphilus tessellata Fitch.

Alnus rubra.
Myzocallis alnifoliae Fitch.
Prociphilus tessellata Fitch.

Alnus rugosa=A. serrulata.
Myzocallis alnifoliae Fitch.
Prociphilus tessellata Fitch.

Alnus vulgaris=A. glutinosa.
Aphis rhamni Kaltenbach.

Alopecurus sp.
Sipha glyceriae italica Del Guercio.

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Alopecurus geniculatus.
Toxoptera graminum Rondani.

Alopecuris pratensis.
Aphis padi Linnaeus.
Lachnus padi Hartig.

Alternanthera sp.
Rhopalosiphum persicae Sulzer.

Althaea sp.
Aphis gossypii Glover.
Aphis malvae Koch.
Aphis urticae Fabricius.

Althaea narborensis.
Rhopalosiphum persicae Sulzer.

Althaea officinalis.
Aphis malvae Walker.
Macrosiphum artemisiae Boyer.
Rhopalosiphum persicae Sulzer.

Althaea rosea.
Macrosiphum pelargonii Kaltenbach.
Rhopalosiphum persicae Sulzer.

Alyssum maritimum.
Macrosiphum achyrantes Monell.

Amaranthus sp.
Aphis gossypii Glover.
Macrosiphum achyrantes Monell.
Rhopalosiphum persicae Sulzer.

Amaranthus caudatus.
Aphis rumicis Linnaeus.

Amaranthus graecizans=A. albus.
Aphis rumicis Linnaeus.
Tychea phaseoli Passerini.

Amaranthus hybridus.
Aphis maidi-radicis Forbes.

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Amaranthus retroflexus.
Aphis cornifoliae Fitch.
Aphis gillettei Cowen.
Aphis maidi-radicis Forbes.
Aphis papaveris Fabricius.
Macrosiphum solanifolii Ashmead.
Trifidaphis radicicola Essig.
Tychea phaseoli Passerini.

Amaranthus spinosus.
Aphis maidi-radicis Forbes.

Ambrosia artemisifolia.
Aphis maidi-radicis Forbes.

Ambrosia psilostachya.
Aphis ambrosia Refinesque.
Macrosiphum ambrosiae Thomas.

Ambrosia trifida.
Aphis maidi-radicis Forbes.
Aphis maidis Fitch.
Macrosiphum ambrosiae Thomas.
Macrosiphum erigeronensis Thomas.
Macrosiphum rudbeckiae Fitch.
Tychea radicola Oestlund.

"Ambulaero aequasola".
Pterocallis pictus Ferrari.

Amelanchier sp.
Illinoia macrosiphum Wilson.

Amelanchier alnifolia.
Pemphigus alnifoliae Williams.
Pemphigus corrugatans Sirrine.

Amelanchier canadensis.
Pemphigus corrugatans Sirrine.

Amelamchier spicata=A. canadensis.
Pemphigus alnifoliae Williams.

Amelanchier ulmifolia.
Pemphigus corrugatans Sirrine.

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Ammannia sp.
Rhopalosiphum persicae Sulzer.
Siphocoryne nymphoeae Linnaeus.

Ammophila arundinacea.
Hyalopterus arundinis Fabricius.
Hyalopterus pruni Fabricius.

Amorphophallus sp.
Macrosiphum circumflexa Buckton.

Amsinckia sp.
Aphis bakeri Cowen.

Amygdalus communis.
Hyalopterus arundinis Fabricius.

Anagallis arvensis.
Aphis nerii Kaltenbach.
Aphis nigra rufa Walker.
Aphis persola Walker.
Aphis rumicis Linnaeus.

Anagallis linifolia.
Aphis nerii Kaltenbach.

Anagallis tenella.
Aphis nerii Kaltenbach.

Anagyris sp.
Aphis craccivora Koch.

Anchusa italica.
Aphis symphiti Schrank.

Anchusa officinalis.
Anoecia corni Fabricius.

Andropogon sp.
Aphis maidis Fitch.

Anemone cylindrica.
Macrosiphum circumflexa Buckton.

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Aphis archangelicae Scopoli.
Aphis rumicis Linnaeus.
Siphocoryne capreae Fabricius.

Siphocoryne archangelicae Oestlund.
Siphocoryne capreae Fabricius.

Angelica sylvestris.
Aphis angelicae Koch.
Aphis humicis Linnaeus.
Cavariella gigliotii Del Guercio.
Siphocoryne angelicae Del Guercio.
Siphocoryne capreae Fabricius.

Anona muricata.
Trichosiphum anonae Pergande.

Anona rectilineata=A. reticulata.
Aphis sasscerí Wilson.

Anthemis sp.
Aphis bakeri Cowen.

Anthemis cotula.
Aphis maidi-radicis Forbes.
Aphis marutae Oestlund.
Rhopalosiphum persicae Sulzer.

Anthemis maritima.
Aphis cardui Linnaeus.

Anthemis nobilis.
Amycla fusicornis Koch.
Aphis chamomillae Koch.
Aphis rumicis Linnaeus.
Pemphigus radicum Boyer.

Anthemis tinctoria.
Aphis balsamitae Müller.
Aphis cardui Linnaeus.
Aphis helichrysi Kaltenbach.
Macrosiphum millefolii DeGeer.

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Anthoxanthum odoratum.
Colopha eragrostidis Middleton.
Tychae graminis Koch.

Anthriscus sylvestris.
Aphis anthrisci Kaltenbach.
Macrosiphum ulmariae Schrank.

Anthriscus vulgaris.
Aphis anthrisci Kaltenbach.
Aphis rumicis Linnaeus.
Macrosiphum ulmariae Schrank.

Antirrhinum majus.
Macrosiphum anthirrhini Macchiati.
Rhopalosiphum galeactitis Macchiati.
Rhopalosiphum persicae Sulzer.

Apera spicaventi.
Macrosiphum cerealis Kaltenbach.

Apium graveolens.
Aphis avenae Fabricius.
Aphis heraclei Koch.
Aphis inculta Walker.
Aphis lappae Koch.
Siphocoryne capreae.

Apium nodiflorum.
Siphocoryne capreae Fabricius.

Apocynum androsaemifolium.
Aphis apocyni Koch.

Apocynum cannabium.
Aphis apocyni Koch.
Aphis asclepiadis Fitch.
Aphis lutescens Monell.

Aquilegia vulgaris.
Aphis acquilegia-canadensis Rafinesque.
Aphis malvae Walker.
Hyalopterus aquilegiae Koch.
Hyalopterus aquilegia-flavus (Kittel) Hayhurst.
Hyalopterus trirhoda Walker.
Hyalopterus flavus Schoutedeor.
Macrosiphum aquilegiae Theobald.
Rhopalosiphum persicae Sulzer.

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Arabis sp.
Macrosiphum circumflexa Buckton.

Arabis canadensis.
Aphis arabis-mollis Rafinesque.

Aralia hispida.
Aphis aralia-hispida Refinesque.

Arenaria sp.
Macrosiphum jaceae Linnaeus.

Arbutus menzeisii.
Rhopalosiphum arbuti Davidson.

Arbutus unedo.
Aphis arbuti Ferrari.

Archangelica sp.
Aphis archangelicae Scopoli.

Arctium sp.
Aphis heraclei Koch.
Aphis radicola Mordwilko.

Arctium lappa.
Aphis angelicae Koch.
Aphis cardui Linnaeus.
Aphis gossypii Glover.
Aphis rumicis Linnaeus.
Aphis symphiti Schrank.
Macrosiphum hieracii Schrank.
Macrosiphum hieracii Kaltenbach.

Arctium minus.
Aphis lappae Koch.
Aphis rumicis Linnaeus.

Arctostaphylos pumila.
Cryptosiphum tahoense Davidson.

Arctostaphylos tomentosa.
Cryptosiphum tahoense Davidson.

Arctostaphylos uva-ursi.
Phyllaphis coweni Cockerell.

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Arenaria peploides.
Aphis aucta Walker.

Aristolochia clematitis.
Aphis papaveris Fabricius.

Arrhenatherum avenaceum.
Toxoptera graminum Rondani.

Arrhenatherum elatius.
Aphis avenae Fabricius.

Artemisia sp.
Aphis bakeri Cowen.

Artemisia abrotanum.
Aphis gallarum Kaltenbach.
Aphis glandulosa Kaltenbach.
Aphis reducta Walker.
Hyalopterus abrotani Koch.
Macrosiphum absinthii Linnaeus.
Macrosiphum artemisiae Boyer.
Macrosiphum atra Ferrari.

Artemisia absinthium.
Aphis artemisiae Passerini.
Aphis plantaginis Schrank.
Macrosiphum absinthii Linnaeus.
Macrosiphum artemisiae Boyer.
Macrosiphum tanacetaria Kaltenbach.
Rhopalosiphum absinthii Lichtenstein.
Syphocoryne angelicae Del Guercio.

Artemisia californica.
Aphis frigidae Oestlund.
Macrosiphum frigidae Oestlund.
Macrosiphoniella fasciata Del Guercio.

Artemisia campestris.
Aphis artemisiae Passerini.
Aphis plantaginis Schrank.
Macrosiphoniella fasciata Del Guercio.
Macrosiphum artemisiae Koch.
Macrosiphum dubia Ferrari.
Macrosiphum ulmariae Schrank.
Lachnus longitarsus Farrari.
Schizoneura karchii Lichtenstein.
Siphocoryne artemisae Del Guercio.
Trama radicis Kaltenbach.

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Artemisia camphorata.
Macrosiphum atra Ferrari.

Artemisia cana.
Aphis artemisicola Williams.
Aphis canae Williams.
Microsiphum canadensis Williams.

Artemisia canadensis.
Microsiphum canadensis Williams.

Artemisia dracunculoides.
Chaitophorus artemisiae Gillette.
Macrosiphum circumflexa Buckton.

Artemisia frigida.
Aphis frigidae Oestlund.
Macrosiphum frigidae Oestlund.

Artemisia ludoviciana.
Macrosiphum ludovicianae Oestlund.
Microsiphum canadensis Williams.

Artemisia maritima.
Aphis amica Walker.
Aphis collega Walker.
Aphis commoda Walker.
Aphis frequens Walker.
Aphis pulvera Walker.

Artemisia tridentata.
Aphis hermistonii Wilson.
Aphis oregonensis Wilson.
Aphis recticulata Wilson.
Aphis tridentatae Wilson.
Chaitophorus tridentatae Wilson.
Macrosiphum artemisae Cowen.
Macrosiphum coweni Hunter.
Microsiphum oregonensis Wilson.

Artemisia variabilis.
Macrosiphum artemisiae Boyer.
Macrosiphum absinthii Linnaeus.
Macrosiphum atra Ferrari.

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Artemisia vulgaris.
Aphis artemisiae Passerini.
Aphis gallarum Kaltenbach.
Aphis glandulosa Kaltenbach.
Aphis plantaginis Schrank.
Cryptosiphum artemisiae Buckton.
Hyalopterus abrotani Koch.
Macrosiphum absinthii Linnaeus.
Macrosiphum artemisiae Boyer.
Macrosiphum artemisiae citrinum Schouteden.
Macrosiphum artemisiae Koch.
Macrosiphum atra Ferrari.
Macrosiphum dubia Ferrari.
Macrosiphum lineatum Van Der Goot.
Macrosiphum ludovicianae Oestlund.
Macrosiphum oblongum Mordwilko.
Macrosiphum tanacetria Kaltenbach.
Myzus pilosus Van Der Goot.
Trama flavescens Koch.
Trama radicis Kaltenbach.

Artocarpus integrifolia.
Greenidea artocarpi Westwood.

Arum italicum.
Macrosiphum circumflexa Buckton.
Siphocoryne nymphaeae Linnaeus.

Arundo sp.
Callipterus arundicolens Clarke.
Hyalopterus arundinis Fabricius.

Arundo donax.
Aphis donacis Passerini.
Stenaphis monticellii Del Guercio.

Arundo phragmitis.
Macrosiphum arundinis Theobald.

Asclepias amplexicaulis.
Myzocallis asclepiadis Monell.

Asclepias curassavica.
Myzus asclepiadis Passerini.

Asclepias grandiflora.
Myzus asclepiadis Passerini.

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Asclepias incarnata.
Aphis lutescens Monell.

Asclepias "lunata".
Myzus asclepiadis Passerini.

Asclepias mexicana.
Aphis lutescens Monell.

Asclepias obtusifolia.
Myzocallis asclepiadis Monell.

Asclepias speciosa.
Aphis asclepiadis Fitch.
Macrosiphum asclepiadis Cowen.

Asclepias stenopylla.
Aphis asclepiadis Fitch.

Asclepias syriaca.
Aphis asclepiadis Fitch.
Aphis lutescens Monell.
Macrosiphum asclepiadifolii Thomas.
Myzocallis asclepiadis Monnell.
Myzus nerii Boyer.
Myzus asclepiadis Passerini.

Asclepias "tridentata".
Macrosiphum asclepiadis Cowen.

Asclepias tuberosa.
Myzus asclepiadis Pasesrini.

Asparagus officinalis.
Aphis gossypii Glover.
Aphis indistincta Walker.
Aphis rumicis Linnaeus.
Phorodon humuli Schrank.
Rhopalosiphum persicae Sulzer.

Asparagus plumosus.
Macrosiphum achyrantes Monell.

Asperula odorata.
Aphis asperulae Walker.
Macrosiphum pisi Kaltenbach.

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Asplenium sp.
Amphorophora ampullata Buckton.

Aster sp.
Aphis helichrysi Kaltenbach.
Macrosiphum circumflexa Buckton.
Macrosiphum solanifolii Ashmead.
Pemphigus asteris Lichtenstein.
Pemphigus brevicornis Hart.

Aster drummondii.
Macrosiphum rudbeckiae Fitch.

Aster ericoides.
Aphis middletonii Thomas.

Aster linosyris.
Macrosiphum campanulae Kaltenbach.
Macrosiphum sonchi Linnaeus.

Aster paniculata.
Aphis oreaster Rafinesque.

Aster subulatus.
Aphis middletonii Thomas.

Aster "trifolium".
Aphis asteris Walker.

Astragulus bisulcatus.
Aphis medicaginis Koch.

Atriplex canescens.
Aphis tetrapteralis Cockerell.

Atriplex hastata.
Aphis atriplicis Linnaeus.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Atriplex hortensis.
Aphis atroplicis Linnaeus.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Atriplex latifolia.
Aphis atriplicis Linnaeus.

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Atriplex littoralis.
Aphis atriplicis Linnaeus.

Atriplex nitens.
Aphis papaveris Fabricius.

Atriplex patula.
Aphis atomaria Walker.
Aphis atriplicis Linnaeus.
Aphis chenopodii Schrank.
Aphis papaveris Fabricius.
Aphis rumicis Linaeus.

Atriplex portulacoides.
Aphis atriplicis Linnaeus.

Atropa belladona.
Macrosiphum atropae Mordwilko.
Macrosiphum solani Kaltenbach.
Rhopalosiphum persicae Sulzer.

Avena sp.
Trinacriella magnifica Del Guercio.

Avena barbata.
Toxoptera graminum Rondani.

Avena fatua.
Aphis avenae Fabricius.
Chaitophorus salicivora Walker.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Avena orientalis.
Aphis avenae Fabricius.

Avena pratensis.
Endies carnosa Buckton.

Avena sativa.
Aphis avenae Fabricius.
Amycla juscifrons Koch.
Endeis bella Koch.
Geoica squamosa Hart.
Liosomaphis rhois Monell.

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Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Macrosiphum trifolii Pergande.
Pemphigus radicum Boyer.
Sipha avenae Del Guercio.
Sipha flavus Forbes.
Sipha maydis Passerini.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.

Avena strigosa.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.

Baccharis sp.
Macrosiphum baccharidis Clarke.

Baccharis viminea.
Macrosiphum rudbeckiae Fitch.

Ballota nigra.
Aphis ballotae Passerini.
Aphis scabiosae Scopoli.
Macrosiphum hieracii Schrank.

Bambusa sp.
Aphis bambusae Fullaway.

Bambusa arundinacea.
Oregma bambusae Buckton.

Barbarea vulgaris.
Rhopalosiphum persicae Sulzer.

Bartsia viscosa.
Aphis bartsiae Walker.

"Beans"
Aphis leguminosae Theobald.

Begonia sp.
Aphis gossypii Glover.
Macrosiphum begoniae Schouteden.

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Bellis perennis.
Aphis bellidis Mosley.
Aphis bellis Buckton.
Aphis dauci Fabricius.
Aphis furcipes Rafinesque.
Aphis plantaginis Schrank.
Rhopalosiphum persicae Sulzer.

Bellis sylvestris.
Rhopalosiphum persicae Sulzer.

Benincasa cerifera.
Aphis rumicis Linnaeus.

Berberis vulgaris.
Aphis berberidis Fitch.
Liosomaphis berberidis Kaltenbach.

Berteroa incana=Alyssum incanum.
Aphis rumicis Linnaeus.

Beta sp.
Macrosiphum betae Theobald.
Symthnurodes betae Westwood.

Beta vulgaris.
Aphis atriplicis Linnaeus.
Aphis brevisiphona Theobald.
Aphis chaerophylli Koch.
Aphis cucumeris Forbes.
Aphis gossypii Glover.
Aphis middletonii Thomas.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Macrosiphum erigeronensis Thomas.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Pemphigus betae Doane.
Rhopalosiphum persicae Sulzer.
Trifidaphis radicicola Essig.

Betula sp.
Aphis betulina Walker.
Aphis callipterus Hartig.
Aphis furcula Zetterstedt.
Aphis inhaerens Walker.

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Aphis punctipennis Zetterstedt.
Myzocallus coryli Goeze.
Pemphigus imbricator Fitch.
Prociphilus tesselata Fitch.
Rhyncholes longirostris Altum.
Thalaxes betulina Buckton.

Betula alba.
Aphis comes Walker.
Aphis impingens Walker.
Aphis nigritarsis Heyden.
Aphis quadrituberculata Kaltenbach.
Calaphis betulella Walsh.
Callipterus betulae Koch.
Callipterus betularia Kaltenbach.
Callipterus betulicola Kaltenbach.
Callipterus carpini Koch.
Callipterus tuberculata Heyden.
Chaitophorus annulatus Koch.
Chaitophorus betulae Buckton.
Chaitophorus betulinus Van Der Goot.
Chaitophorus tricolor Koch.
Euceraphis betulae Linnaeus.
Euceraphis betulaecolens Fitch.
Glyphina alni Schrank.
Hamamelistes betulae Mordwilko.
Mamamelistes betulina Horvath.
Hamamelistes spinosus Shimer.
Hamamelistes tullgreni Meijere.
Hormaphis papyraceae Oestlund.
Monaphis antennata Kaltenbach.
Pterocallis minimus Van Der Goot.
Symdobius alter Mordwilko.
Symdobius oblongus Heyden.
Vacuna betulae Kaltenbach.
Vacuna betulina Buckton.

Betula alpestris.
Hamamelistes betulae Mordwilko.

Betula fontinalis.
Callipterus betulae Koch.
Callipterus betulaecolens Monell.
Euceraphis betulaecolens Fitch.
Euceraphis gillettei Davidson.
Hamamelistes spinosus Shimer.

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Betula nigra.
Calaphis betullea Walsh.
Callipterus betularia Kaltenbach.
Callipterus tuberuclata Heyden.
Chaitophorus annulatus Koch.
Chaitophorus tricolor Koch.
Hamamelistes spinosus Shimer.
Hormaphis hamemelidis Fitch.

Betula papyracea.
Hormaphis papyraceae Oestlund.

Betula tremula.
Callipterus carpini Koch.

Bidens sp.
Aphis gossypii Glover.

Bidens aristosa=Coreopsis aristosa.
Macrosiphum coreopsidis Thomas.

Bidens bipinnata.
Macrosiphum coreopsidis Thomas.

Bidens connata.
Macrosiphum chrysanthemi Oestlund.

Bidens frondosa.
Aphis balsamitae Müller.
Aphis frondosae Oestlund.
Aphis helichrysi Kaltenbach.
Macrosiphum coreopsidis Thomas.
Siphocoryne nymphaeae Linnaeus.

Bidens laevis=B. chrysanthemoides.
Aphis calendulicola Monell.
Macorsiphum calendulae Monell.
Macrosiphum calendulella Monell.
Macrosiphum chrysanthemi Oestlund.
MMacrosiphum rudbeckiae Fitch.

Bidens tripartita.
Aphis helichrysi Kaltenbach.

Bidens vulgata.
Macrosiphum coreopsidis Thomas.

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Blumea balsamifera.
Macrosiphum orientale Van Der Goot.

Borago officinalis.
Aphis cardui Linnaeus.
Aphis rumicis Linnaeus.
Aphis silybi Passerini.

Bougainvillaea virescens.
Aphis papaveris Fabricius.

Brassica sp.
Aphis brassicae-napus Rafinesque.
Macrosiphum tycopersicella Theobald.

Brassica "all species".
Aphis brassicae Linnaeus.
Aphis pseudobrassicae Davis.
Rhopalosiphum persicae Sulzer.

Brassica campestris.
Aphis rumicis Linnaeus.

Brassica juncea.
Aphis maidi-radicis Forbes.
Aphis rhamni Kaltenbach.

Brassica nigra.
Aphis maidi-radicis Forbes.
Macrosiphum sonchi Linnaeus.

Brassica oleracea.
Aphis floris-rapae Curtiss.
Aphis rumicis Linnaeus.
Macrosiphum chelidonii Kaltenbach.
Tychea phaseoli Passerini.

Brassica rapa=B. campestris.
Aphis rumicis Linnaeus.
Macrosiphum solanifolii Ashmead.

Bromus arenarius.
Schizoneura fodiens Buckton.
Schizoneura venusta Passerini.

Bromus arvensis.
Tychea trivialis Passerini.

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Bromus commutatus.
Toxoptera graminum Rondani.
Macrosiphum granarium Kirby.

Bromus erectus.
Toxoptera graminum Rondani.

Bromus hordeaceous=Bromus mollis.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Aploneura lentisci Passerini.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Pentaphis pawlowae Mordwilko.
Toxoptera graminum Rondani.

Bromus inermis.
Aphis avenae Fabricius.
Toxoptera graminum Rondani.

Bromus "maximus".
Toxoptera graminum Rondani.

Bromus mollis
Tychea trivialis Passerini.

Bromus porteri.
Toxoptera graminum Rondani.

Bromus racemosus.
Aphis avenae Fabricius.

Bromus secalinus.
Aphis avenae Fabricius.
Brachycolus tritici Gillette.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Bromus sterilis.
Anoecia corni Fabricius.
Aploneura lentisci Passerini.
Macrosiphum cerealis Kaltenbach.
Macrosiphum roae Macchiati.
Tychea trivialis Passerini.

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Bromus tectorum.
Toxoptera graminum Rondani.

Bromus unioloides.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Schizoneura venusta Passerini.
Toxoptera graminum Rondani.

Brunella vulgaris.
Aphis brunellae Schouteden.

Bunias erucago.
Aphis brassicae Linnaeus.

Butomus umbellatus.
Rhopalosiphum butomi Schrank.
Siphocoryne nymphaeae Linnaeus.

Buxus sempervirens.
Aphis rumicis Linnaeus.

Cacalia suaveolens=Senecio suaveolens.
Macrosiphum rudbeckiae Fitch.

Cacalia tuberosa=Senecio tuberosa.
Macrosiphum rudbeckiae Fitch.

"Cactus".
Forda? myrmecaria Boisduval.

Cakile maritima.
Aphis contermina Walker.
Rhopalosiphum presicae Sulzer.

"Calacosia antiguroum".
Aphis malvae Walker.

Calamagrostis epigeios.
Hyalopterus arundinis Fabricius.
Macrosiphum arundinis Theobald.

Calamagrostis littorea.
Hyalopterus arundinis Fabricius.

Calamintha sp.
Rhopalosiphum calaminthae Lichtenstein.

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Calamintha acinos.
Aphis clinopodii Passerini.
Aphis origani Passerini.

Calamus sp.
Cerataphis lataniae Boisduval.

Calendula arvensis.
Aphis calendulicola Monell.
Macrosiphum calendulae Monell.
Macrosiphum calendullella Monell.
Rhopalosiphum persicae Sulzer.

Calendula officinalis.
Aphis calendulicola Monell.

Calla sp.
Macrosiphum malvae Mosley.
Siphocoryne nymphaeae Linnaeus.

Callistephus hortensis.
Aphis capsellae Kaltenbach.
Aphis maidi-radicis Forbes.

Callitriche autumnalis.
Siphocoryne nymphaeae Linnaeus.

Calluna vulgaris.
Aphis callunae.

Calotropis procera.
Aphis calotropidis Del Guercio.
Aphis paoli Del Guercio.

Caltha palustris.
Aphis nigritarsis Heyden.
Rhopalosiphum calthae Koch.
Rhopalosiphum persicae Sulzer.

Calystegia sp.
Macrosiphum vincae Walker.

Calystegia soldanella.
Aphis derelicta Walker.

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Camellia sp.
Amycla fuscicornis Koch.
Amycla fuscifrons Koch.
Aphis camellicola Del Guercio.

Camellia japonica.
Toxoptera camelliae Kaltenbach.

Camellia oleiferae.
Toxoptera aurantii Boyer.

Camellia thea.
Myzus theacola Buckton.
Toxoptera aurantii Boyer.

Campanula erinus.
Macrosiphum campanulae Kaltenbach.
Macrosiphum sonchi Linnaeus.

Campanula persicifolia.
Macrosiphum campanulae Kaltenbach.

Campanula rotundifolia.
Aphis campanula-riparia Rafinesque.
Macrosiphum campanulae Kaltenbach.
Macrosiphum solidaginis Fabricius.
Macrosiphum sonchi Linnaeus.

Campanula trachelium.
Macrosiphum campanulae Kaltenbach
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Canna indica.
Rhopalosiphum persicae Sulzer.

Cannabis sativa.
Aphis papaveris Fabricius.
Aphis sativae Williams.
Phorodon cannabis Passerini.

Capsella bursa-pastoris.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Aphis brassicae Linnaeus.
Aphis capsellae Kaltenbach.

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Aphis capsellae Koch.
Aphis erysimi Kaltenbach.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.
Aphis papaveris Fabricius.
Aphis plantaginis Schrank.
Aphis rumicis Linnaeus.
Aphis scabiosae Scopoli.
Aphis symphiti Schrank.
Forda occidentalis Hart.
Geoica squamosa Hart.
Macrosiphum pisi Kaltenbach.
Macrosiphum scabiosae Schrank.
Macrosiphum solanifolii Ashmead.
Macrosiphum ulmariae Schrank.
Rhopalosiphum persicae Sulzer.

Capsicum annuum.
Rhopalosiphum persicae Sulzer.

Caragana arborescens.
Aphis medicaginis Koch.
Macrosiphum caraganae Cholodkovsky.

Caragana pygmaea.
Macrosiphum caraganae Cholodkovsky.

Carduus sp.
Aphis flaveola Walker.
Aphis origani Passerini.
Aphis pseudocardui Theobald.
Aphis torticauda Gillette.
Macrosiphum hieracii Schrank.
Rhopalosiphum carduellinum Theobald.

Carduus acanthoides.
Aphis cardui Linnaeus.
Aphis symphiti Schrank.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Carduus crispus.
Aphis cardui Linnaeus.
Aphis symphiti Schrank.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Carduus flodmanii.
Macrosiphum circumflexa Buckton.

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Carduus nutans.
Aphis cardui Linnaeus.
Aphis onopordi Schrank.
Aphis symphiti Schrank.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.
Phorodon carduina Walker.

Carduus ochrocentrus=Cnicus ochrocentrus.
Aphis ochrocentri Cockerell.

Carduus pycnocephalus.
Macrosiphum sonchi Linnaeus.

Carex sp.
Carolinaia caricis Wilson.
Chaitophorus flabellus Sanborn.
Toxoptera caricis Fullaway.

Carex arenaria.
Aphis bufo Walker.

Carex dioica.
Endeis formicina Buckton.

Carex nebraskensis=C. jamesii.
Brachycolus balii Gillette.

Carex pseudo-cyperus.
Aphis caricis Schouteden.

Carpinus betulus.
Callipterus betulicola Kaltenbach.
Callipterus carpini Koch.
Myzocallis coryli Goeze.

Carum sp.
Siphocoryne capreae Fabricius.

Carya sp.
Callipterus caryaefoliae Davis.
Eriosoma caryae Fitch.
Monellia fumipennella Fitch.
Monellia maculella Fitch.
Monellia marginella Fitch.
Phylloxera spinuloida Pergande.
Phylloxera subelliptica Shimer.

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Carya alba.

Longistigma caryae Harris.
Monellia caryella Fitch.
Monellia punctatella Fitch.
Phylloxera caryae-avellana Riley.
Phylloxera caryaecaulis Fitch.
Phylloxera caryae-fallax Riley.
Phylloxera caryaefoliae Fitch.
Phylloxera caryae-globuli Walsh.
Phylloxera caryae-gummosa Riley.
Phylloxera caryae-magnum Shimer.
Phylloxera caryae-scissa Riley.
Phylloxera caryae-septum Shimer.
Phylloxera caryaevenae Fitch.
Phylloxera conica Shimer.
Phylloxera deplanata Pergande.
Phylloxera depressa Shimer.
Phylloxera hemisphericum Shimer.
Phylloxera intermedia Pergande.
Phylloxera perniciosa Pergande.
Phylloxera picta Pergande.
Phylloxera rimosalis Pergande.
Phylloxera symmetrica Pergande.
Phylloxera symmetrica-purpurea Pergande.
Phylloxera symmetrica-vasculosa Pergande.

Carya cordiformis=C. sulcalus.

Longistigma caryae Harris.
Monellia caryaella Fitch.
Phylloxera caryaecaulis Fitch.
Phylloxera caryae-magnum Shimer.
Phylloxera conica Shimer.
Phylloxera conifera Shimer.
Phylloxera foveatum Shimer.
Phylloxera globosum Shimer.
Phylloxera minimum Shimer.
Phylloxera spinosa Shimer.

Carya glabra=C. porcina.

Longistigma caryae Harris.
Phylloxera caryaecaulis Fitch.
Phylloxera caryaefoliae Fitch.
Phylloxera caryae-globuli Walsh.
Phylloxera caryae-ren Riley.
Phylloxera caryae-semen Walsh.
Phylloxera caryae-septum Shimer.
Phylloxera faveola Pergande.

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Phylloxera globosum Shimer.
Phylloxera picta Pergande.
Phylloxera pilosula Pergande.
Xerophylla caryae-pilula Walsh.

Carya illinoensis=C. olivaeformis.
Monellia caryae Monell.
Phylloxera devastatrix Pergande.
Phylloxera georgiana Pergande.
Phylloxera notabilis Pergande.

Carya ovata=C. Alba.
Monellia caryae Monell.
Monellia caryella Fitch.
Phylloxera caryae-avellana Riley.
Phylloxera caryaecaulis Fitch.
Phylloxera caryae-fallax Riley.
Phylloxera caryae-globuli Walsh.
Phylloxera caryae-scissa Riley.
Phylloxera depressa Shimer.
Phylloxera intermedia Pergande.

Castanea sp.
Vacuna castanae Del Guercio.

Castanea dentata.
Callipterus castaneae Fitch.
Phylloxera castaneae Haldeman.

Castanea pumila.
Aphis castanea-vesca Haldeman.
Myzocallis quercus Kaltenbach.

Castanea sativa.
Aphis castanea-vesca Haldeman.
Callipterus castaneae Fitch.
Callipterus castaneae Buckton.
Phylloxera castaneae Haldeman.
Pterochlorus longipes Dufour.
Vacuna carlussiana Del Guercio.

Castanea vesca.
Callipterus castaneae Buckton.
Aphis castanea-vesca Haldeman.

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Catabrosa aquatica.
Siphocoryne aquatica Gillette & Bragg.

Catalpa sp.
Aphis gossypii Glover.
Chaitophorus negundinis Thomas.
Phorodon cynoglossi Williams.

Catalpa bignonoides.
Aphis nerii Kaltenbach.
Sipha bignoniae Macchiati.

Cattleya loddigesii.
Cerataphis lataniae Boisduval.
Ceratovacuna brasiliensis Hempel.

Caucalis daucoides.
Aphis chaerophylli Koch.

Caucalis latifolia.
Aphis rumicis Linnaeus.

Ceanothus cuneatus.
Aphis ceanothi Clarke.

Ceanothus hirsutus.
Aphis ceanothi-hirsuti Essig.

Ceanothus integerrimus.
Aphis ceanothi Clarke.

Cedrus libani.
Aphis sejuncta Walker.

Centaurea calcitrapa.
Aphis rumicis Linnaeus.
Macrosiphum sonchi Linnaeus.

Centaurea collina.
Macrosiphum sonchi Linnaeus.

Centaurea cyanus.
Macrosiphum jaceae Linnaeus.
Macrosiphum solidaginis Fabricius.
Macrosiphum sonchi Linnaeus.

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Centaurea jacea.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.
Trama troplodytes Heyden.

Centaurea maculosa
Macrosiphum jaceae Linnaeus.

Centaurea melitensis.
Aphis centaureae Koch.

Centaurea nigra.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Centaurea nigrescens.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Centaurea scabiosa.
Aphis centaureae Koch.
Aphis terricola Rondani.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Centaurea solstitialis.
Aphis terricola Rondani.

Centaurea sphaerocephala.
Aphis centaureae Koch.

Centranthus sp.
Aphis rumicis Linnaeus.
Macrosiphum rosae Linnaeus.

Centranthus rubra.
Macrosiphum centranthi Theobald.

Cephalanthus occidentalis.
Aphis cephalanthi Thomas.

Cerastium arvense.
Macrosiphum cerastii Kaltenbach.

Cerastium triviale.
Brachycolus stellariae Hardy.

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Ceratonia sp.
Aphis ceratoniae Lichtenstein.

Cercis siliquastrum.
Aphis rumicis Linnaeus.

Chaerophyllum aromaticum.
Aphis chacrophylli Koch.
Rhopalosiphum persicae Sulzer.

Chaerophyllum hirsutum.
Rhopalosiphum persicae Sulzer.

Chaerophyllum roseum.
Rhopalosiphum persicae Sulzer.

Chaerophyllum sylvestris=C. maculatum.
Aphis capsellae Kaltenbach.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Siphocoryne capreae Fabricius.

Chaerophyllum temulum.
Aphis anthrisci Kaltenbach.
Aphis capsellae Kaltenbach.
Aphis chaerophylli Koch.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Siphocoryne capreae Fabricius.

Chaerophyllum tuberosum.
Aphis chaerophilli Koch.

Chaetochloa dactylon.
Toxoptera graminum Rondani.

Chaetochloa glauca.
Macrosiphum granarium Kirby.

Chaetochdoa viridis.
Toxoptera graminum Rondani.

Cheiranthus cheiri.
Pemphigus bursarius Linnaeus.
Pemphigus lactucarius Passerini

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Chelidonium majus.
Macrosiphum chelidonii Kaltenbach.
Macrosiphum urticae Schrank.

"Chenophyllum canadensis".
Aphis chenophyllum-canadense Rafinesque.

Chenopodium sp.
Amycla fuscicornis Koch.
Aphis brevisiphona Theobald.
Pemphigus bursarius Linnaeus.

Chenopodium album.
Aphis atriplicis Linnaeus.
Aphis chenopodii Schrank.
Aphis chenopodii Cowen.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.
Aphis ochropus Koch.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Macrosiphum solanifolii Ashmead.
Pemphigus betae Doane.
Pemphigus brevicornis Hart.
Pemphigus lactucarius Passerini.
Rhopalosiphum persicae Sulzer.

Chenopodium ambrosioides.
Aphis gossypii Glover.

Chenopodium bonus-henricus.
Rhopalosiphum persicae Sulzer.

Chenopodium botrys.
Aphis papaveris Fabricius.

Chenopodium glaucum.
Aphis chenopodii Schrank.

Chenopodium hybridium.
Aphis atriplicis Linnaeus.
Aphis rumicis Linnaeus.

Chenopodium murale.
Aphis atriplicis Linnaeus.

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Chenopodium polysperum.
Aphis atriplicis Linnaeus.

Chenopodium urbicum.
Aphis atriplicis Linnaeus.

Chenopodium vulvaria.
Aphis atriplicis Linnaeus.

Chondrilla juncea.
Macrosiphum sonchi Linnaeus.
Macrosiphoniella bedfordi Theobald.

"Chonodoxia" sp.
Aphis tulipae Boyer.

Chrysanthemum sp.
Aphis calendulicola Monell.
Aphis chrysanthemicola Williams.
Aphis myostidis Koch.
Macrosiphoniella chrysanthemi Del Guercio.
Macrosiphum chrysanthemicolens Williams.
Macrosiphum circumflexa Buckton.
Macrosiphum pelargonii Kaltenbach.
Macrosiphum sanborni Gillette.
Macrosiphum tanacetaria Kaltenbach.

Chrysanthemum balsamita.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.
Macrosiphum artemisiae Boyer.
Rhopalosiphum persicae Sulzer.

Chrysanthemum coccineum.
Coloradoa rufomaculata Wilson.
Rhopalosiphum persicae Sulzer.

Chrysanthemum coronarium.
Aphis beccabungae Koch.

Chrysanthemum frutescens.
Macrosiphum lineatum Van Der Goot.

Chrysanthemum indicum.
Macrosiphum sonchi Linnaeus.

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Chrysanthemum leucanthemum.
Aphis chrysanthemi Koch.
Aphis chrysanthemi Walker.
Aphis beccabungae Koch.
Aphis cardui Linnaeus.
Aphis dauci Fabricius.
Aphis maidi-radicis Forbes.
Aphis plantaginis Schrank.
Aphis rumicis Linnaeus.
Macrosiphum artemisiae Boyer.
Macrosiphum campanulae Kaltenbach.
Macrosiphum tabaci Pergande.

Chrysanthemum segetum.
Aphis persola Walker.
Aphis rumicis Linnaeus.
Macrosiphum sonchi Linnaeus.

Chrysothamnus lanceolatus=Bigelowia lanceolatus.
Aphis chrysothamni Wilson.

"Cichoracerus".
Aphis verticolor Rafinesque.

Cichorium endiva.
Aphis cichorii Dutrochet.
Aphis intybi Koch.
Aphis rumiscis Linnaeus.
Macrosiphum cichorii Koch.
Macrosiphum hieraci Schrank.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.
Rhopalosphum lactucae Kaltenbach.
Rhizobius sonchi Passerini.
Trama troglodytes Heyden.

Cichorium intybus.
Aphis cichorii Dutrechet.
Aphis intybi Koch.
Aphis rumicis Linnaeus.
Macrosiphum cichorii Koch.
Macrosiphum githago Theobald.
Macrosiphum hieracii Schrank.
Macrosiphum hieracii Kaltenbach.
Macrosiphum paceae Linnaeus.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

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Pemphigus bursarius Linnaeus.
Rhizobius sonchi Passerini.
Trama horvathii Del Guercio.
Trama troglodytes Heyden.
Tychea erigeronensis Thomas.

Cicuta virosa.
Aphis angelicae Koch.
Rhopalosiphum cicutae Koch.
Siphocoryne nymphaeae Linnaeus.
Siphocoryne pastinaceae Linnaeus.

Cimicifuga sp.
Aphis rumicis Linnaeus.

Cineraria sp.
Aphis insita Walker.
Macrosiphum circumflexa Buckton.
Macrosiphum solanifolii Ashmead.
Macrosiphum urticae Schrank.
Rhopalosiphum lactucae Kaltenbach.
Rhopalosiphum persicae Sulzer.

Cinchona sp.
Pemphigus cinchona Buckton.

Cirsium altissimum=Cnicus altissimus.
Aphis carduella Walsh.

Cirsium arvense=Cnicus arvensis.
Aphis acanthi Schrank.
Aphis cardui Linnaeus.
Aphis castanea Koch.
Aphis cirsina Ferrari.
Aphis gossypii Glover.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Aphis terricola Rondani.
Macrosiphum cirsii Linnaeus.
Macrosiphum jaceae Linnaeus.
Macrosiphum rudbeckiae Fitch.
Macrosiphum serratulae Schrank.
Macrosiphum sonchi Linnaeus.
Myrus braggii Gillette.
Myzus elaegni Del Guercio.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

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Cirsium lanceolatum=Cnicus lanceolatus.
Aphis carduella Walsh.
Aphis cardui Linnaeus.
Aphis castanea Koch.
Aphis onopordi Schrank.
Aphis rumicis Linnaeus.
Aphis symphiti Schrank.
Macrosiphum artemisicola Williams.
Macrosiphum olivata Buckton.
Macrosiphum sonchi Linnaeus.
Phorodon carduina Walker.

Cirsium muticum=Cnicus muticus.
Aphis cardui Linnaeus.
Aphis rumicis Linnaeus.
Macrosiphum jaceae Linnaeus.
Macrosiphum sonchi Linnaeus.

Cirsium palustre=Cnicus palustre.
Aphis rumicis Linnaeus.
Macrosiphum jaceae Linnaeus.

Cirsium spinosissimus=Cnicus spinosissimus.
Macrosiphum sonchi Linnaeus.

Cistus sp.
Aphis cisti Lichtenstein.
Myzus targionii Del Guercio.

Citrullus vulgaris.
Aphis symphyti Schrank.
Rhopalosiphum persicae Sulzer.

Citrus sp.
Aphis citri Ashmead.
Aphis citricola Van Der Goot.
Aphis citrulli Ashmead.
Aphis cookii Essig.
Aphis gossypii Glover.
Macrosiphum citrifolii Ashmead.

Citrus aurantium.
Aphis asclepiadis Fitch.
Aphis gossypii Glover.
Aphis tavaresi Del Guercio.
Myzus asclepiadis Passerini.
Myzus citricidus Kirkaldy.
Toxoptera aurantiae Koch.
Toxoptera aurantii Boyer.

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Citrus medica.
Aphis tavaresi Del Guercio.
Toxoptera aurantii Boyer.
Toxoptera camelliae Kaltenbach.

Clematis flammula.
Aphis clematidis Koch.

Clematis ligusticifolia.
Myzus varians Davidson.

Clematis recta.
Aphis clematidis Koch.
Aphis vitalbae Ferrari.

Clematis vitalba.
Aphis clematidis Koch.
Aphis vitalbae Ferrari.
Aphis urticae Fabricius.
Aphis urticae Linnaeus.
Toxoptera clematidis Del Guercio.

Cnicus sp.
Aphis cnici Williams.

Cnicus oleraceus.
Aphis acanthi Schrank.
Aphis cnici Schrank.
Macrosiphum serratulae Schrank.
Macrosiphum sonchi Linnaaeus.

Cochlearia armoracia.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Coelia albiflora.
Cerataphis lataniae Boisduval.

Coffea sp.
Toxoptera aurantii Boyer.

Coffea arabica.
Aphis coffeae Nietner.

Coix lachryma-jobi.
Amycla fuscifrons Koch.
Pamphigus boyeri Passerini.
Pemphigus radicum Boyer.
Tychea setariae Passerini.

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Colocasia antiquorum.
Aphis gossypii Glover.
Aphis malvae Walker.
Rhopalosiphum persicae Sulzer.

Colutea arborescens.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Pemphigus coluteae Passerini.

"Compositae".
Aphis compositae Theobald.
Macrosiphum compositae Theobald.

Conium maculatum.
Aphis rumicis Linnaeus.
Macrosiphum cyparissiae cucurbitae Del Guercio.
Siphocoryne capreae Fabricius.
Siphocoryne conii Davidson.
Siphocoryne foeniculi Passerini.
Siphocoryne pastinaceae Linnaeus.
Siphocoryne xylostei Schrank.

Convolvulus sp.
Aphis gossypii Glover.
Rhopalosiphum persicae Sulzer.

Convolvulus althaeoides.
Aphis convolvulicola Ferrari.
Macrosiphum solani Kaltenbach.

Convolvulus arvensis.
Aphis convolvulicola Ferrari.
Amphorophora latysiphon Davidson.
Macrosiphum convoluuli Kaltenbach.

Convolvulus sepium=C. arvemsis.
Macrosiphum convoluli Kaltenbach.

Convolvulus tricolor.
Macrosiphum convoluli Kaltenbach.

Corallorhiza multifolora.
Macrosiphum corralorhizae Cockerell.

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Coreopsis sp.
Aphis avenae Fabricius.
Pemphigus indicus Keiffer.
Siphocoryne capreae Fabricius.

Cornus sp.
Aphis cornifila Del Guercio.
Aphis helianthi Monell.

Cornus amomum.
Anoecia corni Fabricius.
Aphis cornifoliae Fitch.

Cornus asperifolia.
Anoecia corni Fabricius.

Cornus florida.
Aphis cornifoliae Fitch.

Cornus mas.
Aphis gossypii Glover.

Cornus paniculata=C. oblomga.
Anoecia corni Fabricius.
Aphis cornifoliae Fitch.
Aphis maculatae Oestlund.

Cornus sanguinea.
Anoecia corni Fabricius.
Schizoneura corni Hartig.
Schizoneura kochii Lichtenstein.
Vacuna dryophila Schrank.

Cornus stolanifera.
Anoecia corni Fabricius.
Anoecia cornicola Walsh.
Aphis cornifoliae Fitch.

Cornus stricta.
Aphis cornus-stricta Rafinesque.

Coronilla pusilla.
Aphis coronillae Ferrari.

Coronilla varia.
Aphis medicaginis Koch.

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Corydalis aurea.
Macrosiphum corydalis Oestlund.

Corylus americana.
Macrosiphum coryli Davis.

Corylus avellana.
Callipterus betulifola Kaltenbach.
Callipterus carpini Koch.
Callipterus coryli Koch.
Macrosiphum avellanae Koch.
Myzocallis avellanae Schrank.
Myzocallis coryli Goeze.
Myzus tetrahoda Walker.

Corylus rostrata.
Rhopalosiphum corylinum Davidson.

Cosmia sp.
Aphis gossypii Glover.

Cosmos bipinnatus.
Aphis middletonii Thomas.

Cotoneaster interrigma.
Aphis pomi DeGeer.

"Cowpeas"
Aphis leguminosae Theobald.

Crambe maritima.
Aphis brassicae Linnaeus.
Aphis redundans Walker.

Crataegus sp.
Aphis bakeri Cowen.
Prociphilus pyri Fitch.

Crataegus coccinea.
Aphis avenae Fabricius.
Aphis brevis Sanderson.
Aphis crataegifoliae Fitch.
Aphis crataegus-coccinea Rafinesque.
Aphis fitchii Sanderson.
Eriosoma lanigera Hausmann.
Macrosiphum crataegi Monell.

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Crataegus crus-galli.
Aphis pomi DeGeer.
Pemphigus corrugatans Sirrine.

Crataegus "macrocapetra".
Pemphigus corrugatans Sirrine.

Crataegus occidentalis.
Pemphigus corrugatans Sirrine.

Crataegus oxyacantha.
Aphis avenae Fabricius.
Aphis crataegi Kaltenbach.
Aphis crataegi Koch.
Aphis edentula Buckton.
Aphis padi Linnaeus.
Aphis pomi DeGeer.
Aphis pyri Boyer.
Aphis rumicis Linnaeus.
Aphis sorbi Kaltenbach.
Macrosiphum cratacgaria Walker.
Macrosiphum crataegi Monell.
Myzus oxycanthae Schrank.
Ovatus mespili Van Der Goot.
Pemphigus corrugatans Sirrine.
Prociphilus crataegi Tullgren.
Tetraneura ulmi Linnaeus.

Crataegus punctata=C. tomentosa.
Aphis crataegifoliae Fitch.
Eriosoma crataegi Oestlund.
Macrosiphum crataegi Monell.

Crataegus tomentosa.
Eriosoma crataegi Oestlund.
Pemphigus corrugations Sirrine.

Crepis biennis.
Aphis centaureae Koch.
Macrosiphum jaceae Linnaeus.
Macrosiphum hierachii Kaltenbach.
Macrosiphum picridis Fabricius.
Macrosiphum ribicola Kaltenbach.
Macrosiphum sonchi Fabricius.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

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Crepis capillaris.
Macrosiphum picridis Fabricius.
Macrosiphum ribiocola Kaltenbach.
Macrosiphum sonchi Linnaeus.

Crepis foetida.
Macrosiphum sonchi Linnaeus.

Crepis lampsanoides.
Macrosiphum sonchi Linnaeus.

Crepis tectorum.
Macrosiphum hieracii Schrank.
Macrosiphum picridis Fabricius.
Rhopalosiphum lactucae Kaltenbach.
Rhopalosiphum persicae Sulzer.

Crepis virens.
Macrosiphum ribicola Kaltenbach.

Crepis viridis.
Macrosiphum lactucae Linnaeus.
Macrosiphum ribicola Kaltenbach.

Crithmum maritimum.
Aphis crithmi Buckton.

Crocus sp.
Rhopalosiphum persicae Sulzer.

Cryptomaria sp.
Lachnus greeni Schouteden.

Cucubalus sp.
Myzus lychnidis Linnaeus.

Cucumis melo.
Aphis ascita Walker.
Aphis cucumeris Forbes.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.
Rhopalosiphum persicae Sulzer.

Cucumis sativus.
Aphis cucurbiti Buckton.
Aphis gossypii Glover.
Aphis illata Walker.
Aphis papaveris Fabricius.

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Cucurbita clypciformis.
Aphis symphiti Schrank.

Cucurbita maxima.
Aphis cucumeris Forbes.
Aphis cucurbiti Buckton.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.
Aphis symphiti Schrank.
Macrosiphum cucurbitae Thomas.

Cucurbitis pepo.
Aphis cucurbiti Buckton.
Aphis maidi-radicis Forbes.
Aphis papaveris Fabricius.
Aphis symphiti Schrank.
Macrosiphum cucurbitae Thomas.
Rhopalosiphum lactucae Kaltenbach.

Cuphea sp.
Aspis gossypii Glover.
Forda myrmecaria Boisduval.

Cuphea ignea.
Aphis malvae Walker.

Cyclamen sp.
Macrosiphum circumflexa Buckton.

Cydonia vulgaris=Pyrus cydonia.
Aphis avenae Fabricius.
Aphis brevis Sanderson.
Aphis cydoniae Boisduval.
Aphis kochi Schouteden.
Aphis pomi DeGeer.
Macrosiphum solani Kaltenbach.

"Cymonandra".
Aphis nerii Kaltenbach.

Cynara sp.
Aphis cynarae Theobald.
Myzus braggii Gillette.

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Cynara cardunculus.
Aphis cardui Linnaeus.
Aphis intybi Koch.
Macrosiphum dipsaci Schrank.
Macrosiphum sonchi Linnaeus.
Trama troglodytes Heyden.

Cynodon dactylon.
Forda formicaria Heyden.
Pemphigus radicum Boyer.
Schizoneura venusta Passerini.
Sipha avenae Del Guercio.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.
Tychea trivialis Passerini.

Cynoglossum sp.
Aphis cynoglossi Lichtenstein.
Aphis rumicis Linnaeus.
Aphis tuberosae Boyer.
Cerataphis lataniae Boisduval.
Myzocallis cyperis Macchaiti.
Phorodon cynoglossi Williams.

Cynoglossum officinalis.
Aphis adjecta Walker.
Aphis consors Walker.
Aphis cynoglossum Walker.
Aphis particeps Walker.
Aphis petasitidis Buckton.
Asphis socia Walker.
Aphis sodalis Walker.
Aphis symphiti Schrank.

Cyperis laevigatus.
Aphis rumicis Linnaeus.
Aphis tuberosae Boyer.

Cyperis rotundus.
Aphis rumicis Linnaeus.
Myzocallis cyperis Macchaiti.

Cyperus esculentus.
Carolinaia cyperi Ainslie.

Cyperus virens.
Geoica cyperi Schouteden.

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Cyphomandra betacea.
Aphis nerii Kaltenbach.

"Cypress".
Lachnus cypressi Buckton.

Cypripedium sp.
Cerataphis lataniae Boisduval.
Macrosiphum lutea Buckton.
Siphocoryne nymphaeae Linnaeus.

Cyrilla racemiflora.
Pergandeida nigra Wilson.

Cyrtanthus sp.
Rhopalosiphum persicae Sulzer.

Cystopteris montana.
Amphorophora ampullata Buckton.
Rhopalosiphum staphyleae Koch.

Cytisus laburnum.
Aphis cytisorum Hartig.
Aphis genistae Scopoli.
Aphis laburni Kaltenbach.

Cytisus scoparius.
Aphis laburni Kaltenbach.
Aphis rumicis Linnaeus.
Aphis setosa Kaltenbach.
Macrosiphum menthae Buckton.
Macrosiphum pisi Kaltenbach.
Macrosiphum rubi Kaltenbach.
Macrosiphum spartii Koch.
Macrosiphum ulmariae Schrank.
Schizoneura sparthani Boisduval.
Trama troglodytes Heyden.

Dactylis sp.
Sipha glyceriae Kaltenbach.

Dactylis glomerata.
Amphorophora howardii Wilson.
Amphorophora subterrans Wilson.
Aphis avenae Fabricius.
Chaitophorus salicivora Walker.

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Hyalopterus arundinis Fabricius.
Hyalopterus dactylidis Hayhurst.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Dahlia sp.
Aphis dahliae Mosley.

Dahlia coccinea.
Aphis rumicis Linnaeus.

Dahlia nutans.
Aphis rumicis Linnaeus.

Dahlia varabialis
Aphis rumicis Linnaeus.

Daphne sp.
Macrosiphum gnidii Lichtenstein.

Daphne "indica".
Aphis hibernaculorum Boyer.

Datura stramonium.
Aphis gossypii Glover.
Aphis rumicis Linnaeus.

Daucus sp.
Forda dauci Goureau.
Siphocoryne capreae Fabricius.

Daucus carota.
Aphis assueta Walker.
Aphis carotae Koch.
Aphis chaerophilli Koch.
Aphis dauci Fabricius.
Aphis heraclei Koch.
Aphis lappae Koch.
Aphis plantaginis Schrank.
Aphis rumicis Linnaeus.
Aphis umbellatorum Koch.
Siphocoryne foeniculi Passerini.
Siphocoryne pastinaceae Linnaeus.

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Daucus setulosus.
Aphis carotae Koch.

Delphinium "sapellonis."
Aphis rociadae Cockerell.

Dendrobium sp.
Cerataphis lataniae Boisduval.

Dendrocalamus giganteus.
Oregma bambusae Buckton.

Deschampsia ambigua.
Tetraneura graminis Monell.

Deschampsia caespitosa.
Tetraneura graminis Monell.
Tetraneura ulmi Linnaeus.

Deschampsia flexuosa.
Forda viridana Buckton.
Sipha berlesei Del Guercio.
Tetraneura ulmi Linnaeus.

Desmodium canadense.
Microparsus variabilis Patch.

Desmodium canescens.
Macrosiphum desmodii Williams.
Microparsus variabilis Patch.

Desmodium marylandicum.
Microparsus variabilis Patch.

Deutzia scabra.
Aphis rumicis Linnaeus.
Myzus ribis Linnaeus.

Dianthus caryophyllus.
Phorodon cynoglossi Williams.
Rhopalosiphum dianthi Schrank.
Rhopalosiphum persicae Sulzer.

Dianthus plumarius.
Aphis subteranea Walker.

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Diervilla lutea=D. trifida.
Aphis diervilla-lutea Rafinesque.
Pemphigus diani Ferrari.

Digitalis lutea.
Aphis rumicis Linnaeus.

Digitalis purpurea.
Aphis armata Hausmann.
Aphis consumpta Walker.
Aphis pilosa Walker.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Digitaria filiformis=Panicum filiforme.
Tychea trivialis Passerini.

Digitaria humifusa=Panicum glabrum.
Anoecia corni Fabricius.
Anoecia cornicola Walsh.
Macrosiphum panicola Thomas.
Pemphigus boyeri Passerini.
Schizoneura panicola Thomas.
Schizoneura venusta Passerini.
Tychea panici Thomas.
Tychea setariae Passerini.

Digitaria sanguinalis=Panicum sanguinale.
Anoecia corni Fabricius.
Aphis maidi-radicis Forbes.
Aphis maidis Fitch.
Aphis setariae Thomas.
Sipha flavus Forbes.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.

Dioidia teres.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.

Dioscorea bulbifera?
Aphis minuta Wilson.

Diospyros virginiana.
Aphis diospyri Thomas.

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Diplotaxis tenuifolia.
Aphis brassicae Linnaeus.

Dipsacus fullonum.
Macrosiphum rudbeckiae Fitch.

Dipsacus pilosus.
Aphis rumicis Linnaeus.
Macrosiphum dipsaci Schrank.
Macrosiphum rosae Linnaeus.

Dipsacus strigosus.
Macrosiphum rosae Linnaeus.

Dipsacus sylvestris.
Aphis ochropus Koch.
Macrosiphum dipsaci Schrank.
Macrosiphum rosae Linnaeus.

Distichlis spicata.
Pemphigus betae Doane.
Toxoptera graminum Rondani.

Distychium racemosum.
Nipponaphis distychii Pergande.

Distylium racemosum.
Schlectendalia chinensis Bell.

Dolichos sp.
Aphis dolichi Montrouzier.
Aphis medicaginis Koch.

Doronicum cruenta=Senecio cruentus.
Aphis cardui Linnaeus.
Aphis opima Buckton.
Macrosiphum circumflexa Buckton.

Duchesnea indica=Fragaria indica.
Aphis gossypii Glover.
Aphis rumicis Linnaeus.
Macrosiphum fragariae Koch.
Macrosiphum minor Forbes.

Duranta ellisia=D. plumieri.
Aphis nerii Kaltenbach.

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Dysodia sp.
Rhopalosiphum persicae Sulzer.

Ecballium elaterium.
Macrosiphum cyparissae cucurbitae Del Guercio.

Echinochloa crus-galli=Panicum crus-galli.
Anoecia corni Fabricius.
Aphis annuae Oestlund.
Aphis maidis Fitch.
Aphis setariae Thomas.
Geoica squamosa Hart.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Macrosiphum panicola Thomas.
Pemphigus radicum Boyer.
Schizoneura panicola Thomas.
Sipha flavus Forbes.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.
Tychea eregonensis Thomas.

Echinochloa glauca.
Aphis maidi-radicis Forbes.

Echinospermum lappula.
Aphis symphiti Schrank.
Macrosiphum jaceae Linnacus.

Echium vulgare.
Aphis symphiti Schrank.
Macrosiphum jaceae Linnaeus.

Elaeagnus sp.
Rhopalosiphum hippophaës Koch.

Elaeagnus angustifolia.
Myzus elaeagni Del Guercio.

Elaeagnus argentea.
Myzus braggii Gillette.

Eleagnus reflexa=E. umbellata.
Myzus elaeagni Del Guercio.

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Eleusine indica.
Aphis setariae Thomas.
Macrosiphum granarium Kirby.
Rhizobius eleusinis Thomas.
Toxoptera graminum Rondani.

Elodea canadensis.
Siphocoryne nymphaeae Linnaeus.

Elymus sp.
Liosomaphis rhois Monell.

Elymus avenarius.
Hyalopterus arundinus Fabricius.

Elymus canadensis.
Amphorophora howardii Wilson.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Elymus geniculatus—E. arenarius.
Aphis avenae Fabricius.

Elymus striatus.
Toxoptera graminum Rondani.

Elymus virginicus.
Amphorophora howardii Wilson.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

"Emers"=Wheat.
Tychea amycli Koch.

Endive sp.
Aphis middletoni Thomas.

Epidendrum sp.
Ceratovacuna brasilensis Hempel.

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Epilobium sp.
Aphis despecta Walker.
Aphis diphaga Walker.
Aphis epilobiina Walker.
Aphis myosotidis Koch.
Aphis oenotherae Oestlund.
Aphis pollinosa Walker.
Aphis praeterita Walker.
Aphis salicariae Koch.
Aphis tincta Walker.
Aphis triphaga Walker.
Macrosiphum epilobii Pergande.

Epilobium alsinifolium.
Aphis yumicis Linnaeus.

Epilobium angustifolium.
Aphis epilobii Kaltenbach.

Epilobium hirsutum.
Aphis epilobii Kaltenbach.
Aphis penicillata Buckton.

Epilobium molle=E. parviflorum.
Aphis dauci Fabricius.
Aphis epilobii Kittel.
Aphis epilobii Kaltenbach.
Aphis plantaginis Schrank.

Epilobium montanum.
Aphis epilobii Kaltenbach.
Aphis instabilis Buckton.
Aphis penecillata Buckton.
Macrosiphum pisi Kaltenbach.
Macrosiphum rubi Kaltenbach.
Macrosiphum ulmariae Schrank.

Epilobium palustre.
Aphis epilobii Kittel.

Epilobium parviflorum.
Aphis epilobii Kaltenbach.
Aphis instabilis Buckton.

Epilobium roseum.
Aphis epilobii Kaltenbach.

Epilobium virgatum.
Aphis virgata Del Guercio.

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Eragrostis frankii.
Colopha eragrostidis Middleton.

Eragrostis major.
Anoecia corni Fabricius.

Eragrostis megastachya=E. major.
Anoecia corni Fabricius.
Colopha eragrostidis Middleton.
Colopha ulmicola Fitch.
Pemphigus radicum Boyer.
Schizoneura venusta Passerini.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.
Tychea eragrostidis Passerini.

Eragrostis minor.
Colopha eragrostidis Middleton.

Eragrostis pectinacea.
Anoecia corni Fabricius.
Macrosiphum panicola Thomas.

Eragrostis pilosa.
Colopha eragrostidis Middleton.
Toxoptera graminum Rondani.

Erechtites sp.
Aphis myosotidis Koch.

Erica gracilis.
Aphis rumicis Linnaeus.

Erigeron sp.
Aphis rumicis Linnaeus.

Erigeron acris.
Aphis eriogoni Cowen.
Macrosiphum solidaginis Fabricius.

Erigeron canadensis.
Aphis dauci Fabricius.
Aphis erigeron-canadense Rafinesque.
Aphis euphorbiae Kaltenbach.
Aphis helichrysi Kaltenbach.
Aphis middletoni Thomas.

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Aphis maidi-radicis Forbes.
Aphis myosotidis Koch.
Aphis plantaginis Schrank.
Macrosiphum erigeronensis Thomas.
Macrosiphum solidaginis Fabricius.
Tychea erigeronensis Thomas.

Erigeron philadelphicus.
Aphis erigeron-philadelphicum Rafinesque.

Erigeron ramosus=E. divaricatus.
Aphis erigeron-strigosum Rafinesque.
Aphis middletoni Thomas.

Eriobotrya japonica.
Aphis eriobotryae Schouteden.
Aphis pomi DeGeer.

Eriogonum alatum.
Aphis eriogoni Cowen.

Eriogonum ligusticum.
Macrosiphum martini Cockerell.

Eriogonum umbellatum.
Aphis eriogoni Cowen.

Eriophorum vaginatum.
Hyalopterus eriophori Walker.

Erodium botrys.
Rhopalosiphum persicae Sulzer.

Erodium cicutarium.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Eryngium campestre.
Aphis cardui Linnaeus.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Eryngium planum.
Aphis papaveris Fabricius.

Erysimum australe.
Aphis brassicae Linnaeus.

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Erysimum canescens.
Aphis brassicae Linnaeus.

Euchlaena mexicana.
Aphis avenae Fabricius.

Eupatorium ageratoides.
Aphis ageratoides Oestlund.
Macrosiphum eupatorii Williams.

Eupatorium cannabinum.
Aphis eupatorii Passerini.

Eupatorium morisii.
Aphis myosotidis Koch.

Eupatorium perfoliatum.
Aphis eupatorii Oestlund.
Macrosiphum eupatorii Williams.

Eupatorium urticaefolium.
Aphis ageratoides Oestlund.
Macrosiphum eupatorii Williams.

Euphorbia sp.
Acyrthosiphon cyparissiae cyparissiae Mordwilko.

Euphorbia amygdaloides.
Aphis euphorbiae Kaltenbach.
Aphis asclepiadis Fitch.
Aphis rumicis Linnaeus.
Pemphigus brevicornis Hart.

Euphorbia biglandulosa.
Aphis euphorbiae Kaltenbach.

Euphorbia corrollata.
Aphis euphorbiae Kaltenbach.

Euphorbia cyparissia.
Aphis euphorbiae Kaltenbach.
Macrosiphum cyparissiae Koch.

Euphorbia esula.
Aphis euphorbiae Kaltenbach.

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Euphorbia gerardiana.
Acyrthosiphon cyparissiae propinquom Mordwilko.

Euphorbia hirsuta=E. esula.
Macrosiphum euphorbicola Thomas.

Euphorbia lathyrus.
Aphis euphorbiae Kaltenbach.
Tychea phaseoli Passerini.

Euphorbia maculata.
Macrosiphum euphorbiae Thomas.
Rhopalosiphum persicae Sulzer.

Eophorbia marginata.
Macrosiphum euphorbicola Thomas.
Rhopalosiphum persicae Sulzer.

Euphorbia peplus.
Aphis euphorbiae Walker.
Aphis euphorbiae Kaltenbach.
Macrosiphum cyparissiae Koch.
Macrosiphum rosae Linnaeus.
Rhopalosiphum persicae Sulzer.

Euphorbia terracina.
Aphis euphorbiae Kaltenbach.

Euphorbia virgata.
Aphis euphorbiae Kaltenbach.

Euphrasia officinalis.
Aphis euphrasiae Walker.

Evonymus atropurpureus.
Aphis evonymi Fabricius.
Aphis rumicis Linnaeus.

Evonymus europaeus.
Aphis evonymi Fabricius.
Aphis rumicis Linnaeus.
Rhopalosiphum ligustri Kaltenbach.

Evonymus maackii.
Aphis rumicis Linnaeus.

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Fagopyrum sp.
Myzocallis saccharinus Del Guercio.

Fagopyrum esculentum.
Macrosiphum solanifolii Ashmead.
Toxoptera graminum Rondani.

Fagus sp.
Aphis pallipes Hartig.
Chermes fagi Altum.
Pemphigus fagifoliae Del Guercio.
Pemphigus indicus Keiffer.

Fagus ferruginea.
Phyllaphis fagi Linnaeus.

Fagus grandifolia=F. ferruginea.
Phyllaphis fagi Linnaeus.
Pemphigus imbricator Fitch.

Fagus sylvatica.
Lachnus exsiccator Altum.
Pemphigus imbricator Fitch.
Phyllaphis fagi Linnaeus.
Pterochlorus roboris Linnaeus.

Falcaria vulgaris.
Aphis sii Koch.

Festuca sp.
Sipha glyceriae Kaltenbach.

Festuca elatior.
Toxoptera graminum Rondani.
Tychea trivialis Passerini.

Festuca heterophylla=F. ovina?
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Festuca ovina.
Aphis avenae Fabricius.
Brachycolus stellariae Hardy.

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Festuca ovina duriuscula.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Forda formicaria Heyden.
Macrosiphum granarium Kirby.
Paracletus cimiciformis Heyden.
Toxoptera graminum Rondani.
Tychea trivialis Passerini.

Festuca rubra.
Aphis avenae Fabricius.
Toxoptera graminum Rondani.

Festuca tectorum.
Macrosiphum granarium Kirby.

Filago sp.
Aphis flaginis Lichtenstein.
Macrosiphum flaginis Lichtenstein.

Filago gallica.
Anuraphis flaginea Del Guercio.
Anuraphis gallicae Del Guercio.
Myzus flaginis Schouteden.
Pemphigus flaginis Boyer.

Filago germanica.
Anuraphis gallicae Del Guercio.
Aphis gnaphalii Walker.
Pemphigus flaginis Boyer.
Pemphigus gnaphalii Kaltenbach.

Filago minima.
Pemphigus flaginis Boyer.

"Filicales."
Idiopterus nephrelepides Davis.

"Fir trees".
Schizoneura stigma Curtis.

Foeniculum vulgare.
Aphis genistae Scopoli.
Siphocoryne caprae Fabricius.
Siphocoryne foeniculi Passerini.
Siphocoryne pastinaceae Linnaeus.

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Forsythia viridissima.
Macrosiphum tabaci Pergande.

Fragaria sp.
Aphis forbesi Weed.
Aphis rumicis Linnaeus.
Macrosiphum fragariae immaculata Riley.
Macrosiphum minor Forbes.
Macrosiphum rogersii Theobald.
Macrosiphum trifolii Pergande.
Myzus fragaefolii Cockerell.
Myzus porosus Sanderson.

Fragaria grandiflora.
Macrosiphum granarium Kirby.

Fragaria vesca.
Aphis chloris Koch.
Aphis fragariae Walker.
Macrosiphum fragariae Koch.
Macrosiphum fragariella Theobald.
Myzus fragariae Theobald.
Rhizobius sonchi Passerini.

Frasera speciosa.
Macrosiphum martini Cockerell.

Fraxinus sp.
Pemphigus fraxini Hartig.

Fraxinus americana.
Prociphilus fraxini Linnaeus.
Prociphilus fraxinifolii Riley.
Phylloxera? fraxini Stebbins.

Fraxinus dipetala.
Prociphilus fraxini-dipetalae Essig.

Fraxinus excelsior.
Aphis fraxini Fabricius.
Myzocallis coryli Goeze.
Prociphilus bumeliae Schrank.
Prociphilus nidificus Low.
Prociphilus fraxini Linnaeus.

Fraxinus nigra.
Prociphilus fraxinifolii Thomas.

Digitized by Google

Fraxinus oregona.
Prociphilus fraxini Linnaeus.
Prociphilus fraxinifolii Thomas.

Fraxinus pennsylvanicum=F. pubescens.
Prociphilus venafuscus Patch.

Fraxinus quadrangulata.
Prociphilus fraxini Linnaeus.
Prociphilus fraxinifolii Thomas.

Fraxinus sambucifolia.
Prociphilus fraxinifolii Thomas.

Freesia sp.
Macrosiphum circumflexia Buckton.

Fuschia sp.
Forda? myrmecaria Boisduval.

Fuchsia coccinea.
Rhopalosiphum persicae Sulzer.

Fuchsia globosa.
Rhopalosiphum persicae Sulzer.

Fuchsia micrantha.
Rhopalosiphum persicae Sulzer.

Fumaria sp.
Aphis papaveris Fabricius.

Fumaria capreolata.
Aphis rumicis Linnaeus.

Fumaria officinalis.
Aphis fumariae Blanchard.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

"Fungus".
Eriosoma fungicola Walsh.

Funkia subcordata.
Aphis polyanthus Passerini.
Aphis sambuci Linnaeus.
Aphis tuberosai Boyer.

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Galactites tomentosa.
Phorodon inulae Passerini.
Rhopalosiphum galeactitis Macchiati.
Rhopalosiphum persicae Sulzer.

Galeopsis ladanum.
Aphis quaerens Walker.
Aphis symphiti Schrank.
Phorodon galeopsidis Kaltenbach.
Rhizobius sonchi Passerini.

Galeopsis tetrahit.
Phorodon galeopsidis Kaltenbach.

Galium aparine.
Aphis aparines Fabricius.
Aphis aparines Kaltenbach.
Aphis circezandis Fitch.
Aphis galii Kaltenbach.
Aphis galiii Kaltenbach.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Galium circaezandis.
Aphis circezandis Fitch.

Galium cruciata.
Aphis galiii Kaltenbach.
Aphis scabiosae Scopoli.

Galium erectum.
Aphis erecta Del Guercio.

Galium mollugo.
Aphis aparines Schrank.
Aphis aparines Kaltenbach.
Aphis galii Kaltenbach.
Aphis molluginis Koch.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Galium saccharatum.
Aphis galiii Kaltenbach.

Galium verum.
Aphis bicolor Koch.
Aphis galiii Kaltenbach.
Aphis rumicis Linnaeus.

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Gardenia radicans.
Aphis affinis gardeniae Del Guercio.

Gaura parviflora.
Macrosiphum gaurae Williams.
Macrosiphum gaurina Williams.

Genista anglica.
Aphis genistae Kaltenbach.
Aphis rumicis Linnaeus.

Genista germanica.
Aphis rumicis Linnaeus.

Genista ovata.
Aphis rumicis Linnaeus.

Genista tinctoria.
Acyrthosiphon genistae Mordwilko.
Aphis genistae Scopoli.
Aphis genistae Kaltenbach.
Aphis rumicis Linnaeus.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Gentiana cruciata.
Aphis epilobii Kaltenbach.

Geranium maculatum.
Aphis geranii Kaltenbach.
Macrosiphum geranii Oestlund.

Geranium molle.
Rhopalosiphum persicae Sulzer.

Geranium robertianum.
Aphis geranii Kaltenbach.
Macrosiphum pelargonii Kaltenbach.
Macrosiphum urticae Schrank.
Rhopalosiphum persicae Sulzer.

Gerardia tenuifolia.
Macrosiphum gerardiae Thomas.

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Geum urbanum.
Macrosiphum gei Koch.
Macrosiphum pisi Kaltenbach.
Macrosiphum rubi Kaltenbach.
Macrosiphum ulmariae Schrank.

Gladiolus sp.
Aphis gladioli Felt.
Aphis rumicis Linnaeus.
Macrosiphum achyrantes Monell.
Macrosiphum solanifolii Ashmead.

Gladiolus dubius.
Rhopalosiphum persicae Sulzer.

Glaucium sp.
Macrosiphum glaucii Lichtenstein.

Gleditschia triacanthos.
Aphis leguminosae Theobald.

Glochidion philippense.
Schoutedenia ralumensis Rubsaamen.

"Glossanthia"=Klugia?
Aphis verticolor Rafinesque.

Glyceria aquatica.
Sipha glyceriae Kaltenbach.

Glyceria fluitans.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Sipha glyceriae Kaltenbach.

Glyceria nervata.
Amphorophora howardii Wilson.

Glycyrrhiza lepidota.
Aphis medicaginis Koch.

Gnaphalium sp.
Aphis bakeri Cowen.
Aphis swezeyi Fullaway.

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Gnaphalium erectum.
Pemphigus filaginis Boyer.
Pemphigus gnaphalii Kaltenbach.

Gnaphalium purpureum.
Aphis maidi-radicis Forbes.

Gnaphalium uglinosum.
Aphis balsamitae Müller.
Aphis helicrysi Kaltenbach.
Pemphigus filaginis Boyer.

Gomphocarpus fructicosus.
Myzus asclepiadis Passerini.

Gomphorocarpus fructicosus=Gomphocarpus fructicosus?
Aphis gomphorocarpi Van Der Goot.

Gossypium sp.
Acyrtosiphon gossypi Mordwilko.
Acyrtosiphon gossypi gossypi Mordwilko.
Aphis tavaresi Del Guercio.

Gossypium herbaceum.
Aphis dauci Fabricius.
Aphis gossypii Glover.
Aphis malvae Koch.
Aphis medicaginis Koch.
Aphis plantaginis Schrank.
Rhopalosiphum persicae Sulzer.

"Gramineae".
Aphis hordei Kyber.
Aphis littoralis Walker.
Forda flavula Rohwer.
Forda olivacea Rohwer.

Grass.
Anoecia pskovica Mordwilko.
Atheroides serrulatus Haliday.
Chaitophorus flabellus Sanborn.
Forda kingii Cockerell.
Forda marginata Koch.
Forda olivacea Rohwer.
Macrosiphum graminum Theobald.
Tychea groenlandica Rubsaamen.

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Gratiola officinalis.
Aphis chloris Koch.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Grindelia squarrosa.
Anoecia corni Fabricius.
Atarsos grindeliae Gillette.
Macrosiphum grindeliae Williams.

Hamamelis virginiana.
Hamamelistes cornu Shimer.
Hamamelistes spinosus Shimer.
Hormaphis hamamelidis Fitch.

Hedera helix.
Aphis angelicae Koch.
Aphis hederae Kaltenbach.
Aphis hederella Theobald.
Macrosiphum hederae Theobald.
Pemphigus hederae Horvath.
Rhopalosiphum persicae Sulzer.

Helenium hoopesii.
Macrosiphum heleniella Cockerell.
Macrosiphum martini Cockerell.

Helianthemum "tenuifolium".
Aphis maidi-radicis Forbes.

Helianthemum vulgare.
Aphis helianthemi Ferrari.

Helianthus annuus.
Aphis helianthi Monell.
Aphis maidi-radicis Forbes.

Helianthus divaricatus.
Aphis helianthi Monell.

Helianthus giganteus.
Aphis helianthi Monell.

Helianthus grosse-serratus.
Aphis helianthi Monell.

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Helianthus petiolaris.
Aphis gillettei Cowen.
Aphis helianthi Monell.

Helianthus scaberrimus.
Aphis helianthi Monell.

Helianthus tuberosus.
Aphis helianthi Monell.
Rhizobius helianthemi Westwood.

Helichrysum angustifolia.
Macrosiphum absinthii Linnaeus.

Helichrysum arenarium.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.

Helichrysum chrysanthemum=H. bracteatium.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.
Aphis rumicis Linnaeus.

Helichrysum stoechas.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.

Heliotropium europaeum.
Aphis heliotropii Macchiati.
Macrosiphum solani Kaltenbach.

Heliotropium peruvianum.
Rhopalosiphum staphyleae Koch.
Rhopalosiphum persicae Sulzer.

Heracleum lanatum.
Aphis heraclii Cowen.
Siphocoryne pastinaceae Linnaeus.

Heraclium spondylium.
Aphis chaerophylli Koch.
Aphis heraclei Koch.
Hyalopterus spondylii Koch.
Phorodon galeopsidis Kaltenbach.
Siphocoryne capreae Fabricius.

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Hesperis matronalis.
Aphis brassicae Linnaeus.

Heteropogon hirtus.
Toxoptera graminum Rondani.

Heuchera "hartwegii".
Macrosiphum heucherae Thomas.

Heuchera hispida.
Macrosiphum heucherae Thomas.

Hibiscus sp.
Aphis malvae Walker.
Aphis medicaginis Koch.
Rhopalosiphum persicae Sulzer.

Hibiscus rosa-sinensis.
Aphis gossypii Glover.

Hieracium gronovii.
Aphis annulipes Rafinesque.

Hieracium murorum.
Macrosiphum hieracii Schrank.
Macrosiphum hieracii Kaltenbach.
Macrosiphum jaceae Linnaeus.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

Hieracium paniculatum.
Aphis annulipes Rafinesque.
Aphis hieracium-paniculatum Rafinesque.

Hieracium pilosella.
Amycla fuscifrons Koch.
Macrosiphum hieracii Kaltenbach.
Macrosiphum hieracii Schrank.
Macrosiphum picridis Fabricius.
Myzus tetrahoda Walker.
Pemphigus radicum Boyer.
Rhizobius pilosellae Burmeister.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

Hieracium prealtum.
Macrosiphum obscura Koch.

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Hieracium spondylium.
Hyalopterus spondylii Koch.
Macrosiphum hieracii Schrank.
Macrosiphum hieracii Kaltenbach.
Macrosiphum picridis Fabricius.

Hieracium sylvaticum=Hieracium (sp.?)
Macrosiphum hieracii Kaltenbach.
Macrosiphum hieracii Schrank.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

Hieracium sylvestris=H. boreale?
Macrosiphum hieracii Schrank.
Macrosiphum hieracii Kaltenbach.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

Hieracium umbellatum.
Aphis cardui Linnaeus.
Aphis helichrysi Kaltenbach.
Aphis scabiosae Scopoli.
Macrosiphum hieracii Kaltenbach.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

Hieracium vavietis.
Macrosiphum hieracii Kaltenbach.

Hieracium venosum.
Aphis hieracium-venosum Rafinesque.
Aphis verticolor Rafinesque.

Hieracium vulgatum.
Macrosiphum picridis Fabricius.

Hierochloae australis.
Schizoneura venusta Passerini.

Hippophaë rhamnoides.
Rhopalosiphum hippophaës Koch.

Holcus sp.
Aphis holci Hardy.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Sipha schoutedeni Schouteden.

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Holcus lanatus.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Brachycolus stellariae Hardy.
Forda formicaria Heyden.
Macrosiphum cerealis Kaltenbach.

Holcus mollis.
Aphis holci Ferrari.
Brachycolus stellariae Hardy.
Forda formicaria Heyden.
Macrosiphum cerealis Kaltenbach.
Sipha maydis Passerini.

Hordeum sp.
Schizoneura cerealium Szaniszlo.

Hordeum caespitosum.
Toxoptera graminum Rondani.

Hordeum distichon.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.

Hordeum hexastichon.
Aphis avenae Fabricius.

Hordeum jubatum.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Macrosiphum granarium Kirby.
Pemphigus betae Doane.
Toxoptera graminum Rondani.

Hordeum murinum.
Aphis avenae Fabricius.
Aphis hordei Del Guercio.
Liosomaphis rhois Monell.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Macrosiphum dirhoda Walker.
Sipha avenae Del Guercio.
Sipha elegans Del Guercio.
Sipha maydis Passerini.
Sipha maydis avenae Del Guercio.
Toxoptera graminum Rondani.

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Hordeum pusillum=H. secalinum.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Hordeum vulgare.
Aphis africana Theobald?
Aphis avenae Fabricius.
Aphis hordei Kyber.
Aphis maidis Fitch.
Endeis bella Koch.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Rhopalosiphum persicae Sulzer.
Sipha maydis Passerini.
Toxoptera graminum Rondani.

Hordeum vulgare-himalayense.
Macrosiphum cerealis Kaltenbach.

Humulus lupulus.
Aphis gossypii Glover.
Myzus phenax Cockerell.
Phorodon humuli Schrank.

Hyacinthus orientalis.
Rhopalosiphum persicae Sulzer.

Hydrangea sp.
Aphis gossypii Glover.
Macrosiphum pelargonii Kaltenbach.

Hydrangea hortensia.
Aphis nerii Kaltenbach.
Macrosiphum circumflexa Buckton.

Hydrocharis morsus-ranae.
Siphocoryne nymphaeae Linnaeus.

Hydrocotyle vulgaris.
Siphocoryni nymphaeae Linnaeus.

Hyoscyamus niger.
Aphis hyosciami Kittel.
Macrosiphum ulmariae Schrank.
Rhopalosiphum dianthi Schrank.

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Hyoseris radiata.
Macrosiphum sonchi Linnaeus.
Macrosiphum ulmariae Schrank.

Hypericum sp.
Macrosiphum scabiosae Schrank.

Hypericum crispum.
Aphis chloris Koch.

Hypericum hirsutum.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Hypericum kalmianum.
Callipterus hyperici Monell.

Hypericum montanum.
Aphis chloris Koch.
Aphis rumicis Linnaeus.

Hypericum perforatum.
Aphis chloris Koch.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Hypericum prolificum.
Callipterus hyperici Monell.
Myzocallis hyperici Thomas.

Hypericum quadrangulum.
Aphis rumicis Linnaeus.

Hypochoeris sp.
Macrosiphum picridis Fabricius.

Hypochoeris maculata.
Macrosiphum jaceae Linnaeus.

Ilex aquilfolium.
Aphis hederae Kaltenbach.
Aphis ilicis Kaltenbach.
Aphis rumicis Linnaeus.

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Impatiens Biflora.
Aphis impatientis Thomas.
Macrosiphum carnosa-impatiens Williams.
Macrosiphum fulvae Oestlund.

Impatiens pallida=I. aurea.
Aphis impatientis Thomas.
Macrosiphum carnosa-impatiens Williams.
Macrosiphum fulvae Oestlund.

Inula conyza.
Phorodon inulae Passerini.

Inula dysenterica=I. britannica?
Aphis inulae Walker.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Inula graveolens.
Phorodon inulae Passerini.
Rhopalosiphum hippophaës Koch.

Inula helenium
Macrosiphum jaceae Linnaeus.

Inula squarrosa.
Aphis plataginis Schrank.
Macrosiphum jaceae Linnaeus.

Inula viscosa.
Aphis rumicis Linnaeus.
Macrosiphum bifrontis Passerini.
Macrosiphum inulae Ferrari.
Phorodon inulae Passerini.

Ionidum concolor.
Rhopalosiphum persicae Sulzer.

Ipomoea? (Aero potato).
Aphis gossypii Glover.
Aphis minuta Wilson.

Ipomoea purpurea.
Macrosiphum convolvuli Kaltenbach.

Iresine lindeni.
Rhopalosiphum persicae Sulzer.

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Iris sp.
Macrosiphum solanifolii Ashmead.

Iris florentina.
Aphis iridis Del Guercio.

Iris pumila.
Rhopalosiphum persicae Sulzer.

Isatis tinctoria.
Aphis brassicae Linnaeus.
Aphis isatidis Boyer.

Iva sp.
Pemphigus brevicornis Hart.

Iva xanthifolia.
Aphis cornifoliae Fitch.
Macrosiphum ambrosiae Thomas.
Pemphigus betae Doane.

"Japanese Lillies".
Macrosiphum lilii Monell.

"Jasmine".
Macrosiphum jasmini Clarke.

Jasminum officinale.
Aphis rumicis Linnaeus.

Juglans californica.
Monellia califarnicus Essig.
Monellia caryella Fitch.

Juglans nigra.
Aphis juglandina Walker.
Chromaphis juglandicola Kaltenbach.
Monellia caryae Monell.
Eriosoma caryae Fitch.
Longistigma caryae Harris.

Juglans regia.
Aphis juglandina Walker.
Aphis juglandis Blanchard.
Callipterus juglandicola Koch.

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Callipterus juglandis Goeze.
Chromaphis juglandicola Kaltenbach.
Macrosiphum picridis Fabricius.
Monellia caryae Monell.

Juncus "articulatus".
Atheroides hirtellus Haliday.

Juncus effusus.
Sipha glyceriae Kaltenbach.

Juncus lampocarpus.
Aphis cyperi Walker.
Sipha glyceriae Kaltenbach.
Siphocoryne nymphaeae Linnaeus.

Juncus tenuis.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

"Jungle creeper".
Trichosiphum minutum Van Der Goot.

Juniperus communis.
Aphis incerta Walker.
Aphis indecisa Walker.
Lachnus confinis Koch.
Lachnus juniperi DeGeer.
Lachnus juniperinus Mordwilko.
Lachnus rubicundus Wilson.

Justica furcata.
Macrosiphum diplanterae Koch.
Macrosiphum pelargonii Kaltenbach.

Kamtshatka orientalis.
Acyrthosiphon kamtshatkanum Mordwilko.

Koeleria cristata.
Aphis avenae Fabricius.

Krigia virginica.
Aphis maidi-radicis Forbes.

Laburnum anagyroides.
Aphis rumicis Linnaeus.

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Lactuca sp.
Macrosiphum solanifolii Ashmead.
Pemphigus lactucae Westwood.
Rhopalisiphum lactucellum Theobald.

Lactuca macrophylla.
Macrosiphum allariae Koch.
Macrosiphum kaltenbachi Schouteden.

Lactuca muralis.
Macrosiphum muralis Buckton.
Macrosiphum rudbeckiae Fitch.

Lactuca oleracea.
Macrosiphum lactucae Linnaeus.
Rhopalosiphum lactucae Kaltenbach.

Lactuca perennis.
Macrosiphum lactucae Linnaeus.

Lactuca pulchella.
Macrosiphum erigeronensis Thomas.

Lactuca saligna.
Pemphigus bursarius Linnaeus.

Lactuca sativa.
Macrosiphum ulmariae Schrank.

Lactuca scariola.
Aphis lactuca Boyer.
Macrosiphum allariae Koch.
Macrosiphum erigeronensis Thomas.
Macrosiphum lactucae Linnaeus.
Macrosiphum lactucae Passerini.
Macrosiphum pisi Kaltenbach.
Mocrosiphum rudbeckiae Fitch.
Macrosiphum sonchi Linnaeus.
Macrosiphum ulmariae Schrank.
Pemphigus bursarius Linnaeus.
Pemphigus lactucarius Passerini.
Rhizobius lactucae Fitch.
Rhopalosiphum lactucae Kaltenbach.
Trama caudata Del Guercio.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

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Lactuca spicata=L. alpina.
Rhopalosiphum persicae Sulzer.

Lactuca virosa.
Macrosiphum jaceae Linnaeus.
Macrosiphum lactucae Linnaeus.
Macrosiphum lactucae Passerini.
Pemphigus bursarius Linnaeus.
Tychea setariae Passerini.

Lagerstroemia indica.
Aphis lagerströmiae Lichtenstein.
Myzocallis kahawaluokalani Kirkaldy.

Lamium sp.
Pterocomma farinosus Del Guercio.

Lamium album.
Aphis helichrysi Kaltenbach.
Phorodon galeopsidis Kaltenbach.

Lamium amplexicaule.
Phorodon galeopsidis Kaltenbach.

Lamium maculatum.
Aphis helichrysi Kaltenbach.

Lamium purpureum.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach
Aphis lamii Koch.
Aphis rumicis Linnaeus.
Chaitophorus montemartini Del Guercio.
Macrosiphum lamii Theobald.
Myzus lamii Van Der Goot.
Phorodon galeopsidis Kaltenbach.

"Lantana" sp.
Forda myrmecaria Boisduval.

Lapsana communis.
Macrosiphum alliariae Koch.
Macrosiphum sonchi Linnaeus.
Myzus tenaceti Linnaeus.
Rhopalosiphum lactucae Kaltenbach.
Siphocoryne lonicerae Siebold.

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Larix sp.
Adelges laricis Vallot.
Chermes lapponicus Cholodkovsky.
Chermes laricis Hartig.
Chermes strobilobius tradoides Cholodkovsky.
Chermes viridis Ratzeburg.
Chermes viridis viridis Cholodkovsky.
Coccus laricis (Bouche) Baerensprung.
Pemphigus piceae Hartig.
Periphyllus laricae Haliday.

Larix decidua=Larix europea.
Anisophleba hamadryas Koch.
Aphis tenuior Walker.
Chermes abietis Linnaeus.
Chermes coniferarum Cholodkovsky.
Chermes geniculatus Ratzeburg.
Chermes strobilobius Kaltenbach.
Chermes tardus Dreyfus.
Chermes viridanus Cholodkovsky.
Chermes viridis lutescens Cholodkovsky.
Onaphalodes affinis Börner.
Lachniella laricina Del Guercio.
Lachniella laricis cuneomaculata Del Guercio.
Lachniella nigrotuberculata Del Guercio.
Lachnus laricis Koch.
Lachnus laricis Walker.
Lachnus maculosus Cholodkovsky.
Lachnus pini Linnaeus.
Lachnus pinicola Kaltenbach.

Larix laricina=L. americana.
Chermes consolidatus Patch.
Chermes lariciatus Patch.
Chermes laricifoliae Fitch.
Chermes strobilobius Kaltenbach.
Lachnus laricifex Fitch.

Larix leptolassa.
Lachniella nigrotuberculata Del Guercio.

Larix occidentalis.
Lachnus laricifoliae Wilson.

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Larix sibirica.
Chermes abietis Linnaeus.
Chermes viridanus Cholodkovsky.
Chermes viridulus Cholodkovsky.
Lachnus laricis Walker.
Lachnus maculosus Cholodkovsky.

Latania barbonica=L. commersonii?
Cerataphis lataniae Boisduval.

Lathraca squamaria.
Aphis orobanches Passerini.

"Lathyro" sp.
Acyrthosiphon pisi ussuriensis Mordwilko.

Lathyrus sp.
Megoura vicia Buckton.

Lathyrus latifolius.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Macrosiphum viciae Kaltenbach.

Lathyrus odoratus.
Aphis brevis Sanderson.
Aphis dissita Walker.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Lathyrus pisiformis.
Macrosiphum pisi Kaltenbach.

Lathyrus pratensis.
Macrosiphum pisi Kaltenbach.
Macrosiphum viciae Kaltenbach.
Macrosiphum ulmariae Schrank.

Lathyrus sativus.
Macrosiphum pisi Kaltenbach.

Lathyrus sylvestris.
Macrosiphum pisi Kaltenbach.
Macrosiphum viciae Kaltenbach.

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Laurus laurustinus?
Aphis pomi DeGeer.

Lavatera sp.
Aphis epilobii Kittel.
Aphis lavaterae Kittel.

Lavatera arborea.
Aphis malvae Koch.

Leersia oryzoides.
Sipha glyceriae Kaltenbach.

Leersia virginica.
Tetraneura graminis Monell.

Lemna gibba.
Siphocoryne nymphaeae Linnaeus.

Lemna minor.
Aphis sambuci Linnaeus.
Siphocoryne nymphaeae Linnaeus.

Lemna polyrhiza.
Siphocoryne nymphaeae Linnaeus.

Lemna trisulca.
Siphocoryne nymphaeae Linnaeus.

Leontodon sp.
Trama troglodytes Heyden.

Leontodon autumnalis.
Macrosiphum picridis Fabricius.
Machrosiphum sonchi Linnaeus.

Leontodon hispida.
Macrosiphum picridis Fabricius.
Machrosiphum sonchi Linnaeus.

Leontodon taraxaci.
Aphis plantaginis Schrank.
Macrosiphum taraxaci Kaltenbach.
Trama horvathi Del Guercio.
Trama radicis Kaltenbach.

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Leontopodium alpinum.
Aphis leontopodii Schouteden.

Leonurus cardiaca.
Aphis helichrysi Kaltenbach.
Aphis plantaginis Schrank.
Phorodon galeopsidis Kaltenbach.

Lepidium draba.
Aphis myosotidis Koch.

Lepidium incisum.
Aphis maidi-radicis Forbes.

Lepidium sativum.
Aphis brassicae Linnaeus.
Aphis myosotidis Koch.
Rhopalosiphum persicae Sulzer.

Lepidium perfoliatum.
Acyrthosiphon gossypii paczoskii Mordwilko.

Lepidium virginicum.
Aphis acaroides Rafinesque.
Aphis gossypii Glover.

Lepidium vulgare.
Aphis maidi-radicis Forbes.

Leptochloa filiformis.
Aphis maidi-radicis Forbes.

Ligusticum sp.
Macrosiphum martini Cockerell.

Ligusticum scoticum.
Aphis ligustici Fabricius.

Ligustrum sp.
Aphis ligustri Mosley.
Aphis ligustriella Theobald.

Ligustrum vulgare.
Asiphum ligustrinellum Koch.
Rhopalosiphum ligustri Kaltenbach.

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Lilium sp.
Aphis sinensis Del Guercio.
Macrosiphum lilii Monell.
Macrosiphum pelargonii Kaltenbach.

Lilium candidum.
Aphis gossypii Glover.
Aphis lilicola Williams.
Aphis lilii Lichtenstein.
Macrosiphum circumflexa Buckton.
Rhopalosiphum persicae Sulzer.

Limnanthemum nymphoides.
Siphocoryne nymphaeae Linnaeus.

Linaria canadensis.
Aphis maidi-radicis Forbes.

Linaria cymbalaria.
Aphis cymbalariae Schouteden.
Aphis linariae Lichtenstein.

Linaria vulgaris.
Macrosiphum linariae Koch.

Liotris sp.
Siphocoryne capreae Fabricius.

Lippia citriodora.
Myzus ribis Linnaeus.
Myzus targioni Del Guercio.

Liriodendron tulipifera.
Macrosiphum liriodendri Monell.
Macrosiphum liriodendri rufa Monell.
Rhopalosiphum tulipae Thomas.

Lithospermum arvense.
Macrosiphum jaceae Linnaeus.

Lithospermum fruticosum.
Macrosiphum jaceae Linnaeus.

Lithospermum officinale.
Aphis cardui Linnaeus.
Macrosiphum jaceae Linnaeus.

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Lithospermum pilosum.
Aphis lithospermii Wilson.

"Locus=Locust?
Aphis medicaginis Koch.

Lolium sp.
Brachycolus korotnewi Mordwilko.

Lolium multiflorum.
Aphis avenae Fabricius.
Macrosiphum granarium Kirby.
Sipha maydis Passerini.
Toxoptera graminum Rondani.

Lolium perenne.
Aphis avenae Fabricius.
Forda formicaria Heyden.
Macrosiphum cerealis Kaltenbach.
Pemphigus radicum Boyer.
Schizoneura venusta Passerini.
Sipha maydis Passerini.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.

Lolium temulentum.
Schizoneura venusta Passerini.
Sipha maydis Passerini.
Toxoptera graminum Rondani.

Lonicera sp.
Aphis lonicerae Boyer.
Aphis lonicerae Mosley.
Rhopalosiphum pastinaceae Koch.

Lonicera caprifolium.
Siphocoryne xylostei Schrank.

Lonicera dioica=L. glauca.
Aphis lonicericola Williams.
Chaitophorus lonicerae Monell.

Lonicera involucrata.
Rhopalosiphum grabhami Cockerell.

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Lonicera japonica.
Siphocoryne lonicerae Siebold.
Siphocoryne xylostei Schrank.

Lonicera periclemenum.
Siphocoryne lonicerae Siebold.
Siphocoryne xylostei Schrank.

Lonicera tatarica.
Siphocoryne lonicerae Siebold.

Lonicera xylosteum.
Pemphigus lonicerae Hartig.
Prociphilus xylostei DeGeer.
Siphocoryne lonicerae Siebold.
Siphocoryne xylostei Schrank.

Lophospermum erubescens.
Macrosiphum lophospermum Theobald.

Lotus corniculatus.
Aphis loti Kaltenbach.
Aphis rumicis Linnaeus.
Macrosiphum loti Theobald.
Macrosiphum pisi Kaltenbach

Lotus uliginosus.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Lupinus sp.
Rhopalosiphum persicae Sulzer.

Lupinus albifrons=L. chamissonis.
Macrosiphum albifrons Essig.

Lupinus moritzianus=L. elegans.
Aphis nerii Kaltenbach.

Luzula albida.
Aphis luzulae Kaltenbach.

Lychnis alba.
Myzus lychnidis Linnaeus.

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Lychnis dioica.
Aphis dauci Fabricius.
Aphis plantaginis Schrank.
Forda dauci Goureau.
Macrosiphum pisi Kaltenbach.
Macrosiphum solani Kaltenbach.
Myzus lychnidis Linnaeus.

Lychnis divaricata.
Myzus lychnidis Linnaeus.

Lychnis viscaria.
Myzus lychnidis Linnaeus.

Lycium europaeum.
Chaitophorus xanthomelas Koch.

Lycopersicum esculentum.
Aphis gossypii Glover.
Aphis rumicis Linnaeus.
Lachnus subterraneous Del Guercio.
Macrosiphum lycopersicella Theobald.
Macrosiphum lycopersici Clarke.
Macrosiphum tabaci Pergande.
Megoura solani Thomas.
Rhopalosiphum persicae Sulzer.

Lycopsis arvensis.
Aphis adjecta Walker.
Aphis adjucta Walker.
Aphis adjuvans Walker.
Aphis adscita Walker.
Aphis basilis Walker.
Aphis bufo Walker.
Aphis conjuncta Walker.
Aphis consueta Walker.
Aphis familiaris Walker.
Aphis lycopsidis Walker.
Aphis suffragans Walker.

Lysimachia sp.
Aphis rumicis Linnaeus.
Pemphigus bursarius Linnaeus.

Lythrum salicaria.
Aphis salicariae Koch.
Myzus lythri Schrank.

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"Macrophylla".
Macrosiphum sonchi Linnaeus.

Magnolia sp.
Aphis rumicis Linnaeus.

Magnolia grandiflora.
Aphis magnoliae Macchiati.

"Malopa trimestri"=Malope trimestri?
Aphis malvae Koch.
Aphis urticae Fabricius.

Malva sp.
Aphis eupatorii Passerini.
Macrosiphum malvae Mosley.
Siphocoryne alboapicalis Theobald.

Malva moschata.
Macrosiphum urticae Schrank.

Malva neglecta=Malva rotundifolia.
Acyrthosiphon skrjabini Mordwilko.
Macrosiphum pelargonii Kaltenbach.

Malva parviflora.
Aphis malvae Koch.
Macrosiphum achyrantes Monell.
Rhopalosiphum persicae Sulzer.

Malva rotundifolia.
Aphis cardui Linnaeus.
Aphis gossypii Glover.
Aphis malvae Koch.
Aphis malvae Walker.
Macrosiphum pallida Walker.
Myzus malvae Oestlund.
Rhopalosiphum persicae Sulzer.

Malva sylvestris.
Aphis addita Walker.
Aphis cardui Linnaeus.
Aphis malvae Koch.
Aphis malvae Walker.
Aphis urticae Fabricius.
Macrosiphum diplantereae Koch.

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Macrosiphum pallida Walker.
Macorsiphum pelargonii Kaltenbach.
Macrosiphum urticae Schrank.
Rhopalosiphum persicae Sulzer.

Malvastrum coccineum.
Macrosiphum circumflexa Buckton.
Rhopalosiphum persicae Sulzer.

Marrubium sp.
Aphis ballotae Passerini.

Marsilea quadrifolia.
Siphocoryne nymphaeae Linnaeus.

Marsilea vestita.
Rhopalosiphum persicae Sulzer.

Matricaria sp.
Aphis balsamitae Müller.
Aphis helichrysi Kaltenbach.
Macrosiphum leucanthemi Ferrari.
Macrosiphum leucanthemi Scopoli.

Matricaria chamomilla.
Aphis cardui Linnaeus.
Aphis chamomillae Koch.
Aphis chrysanthemi Koch.
Aphis consolidae Passerini.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Myzus matricariae Macchiati.

Matricaria inodora.
Aphis chrysanthemi Koch.
Aphis instabilis Buckton.
Aphis papaveris Fabricius.

Maurandia "hendersoni".
Rhopalosiphum persicae Sulzer.

Medicago sp.
Macrosiphum creelii Davis.

Medicago denticulata.
Aphis gossypii Glover.
Aphis medicaginis Koch.

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Medicago falcata.
Aphis medicaginis Koch.
Macrosiphum pisi Kaltenbach.

Medicago hispida.
Aphis medicaginis Koch.

Medicago lupulina.
Aphis medicaginis Koch.

Medicago orbicularis.
Macrosiphum ulmariae Schrank.

Medicago sativa.
Acyrthosiphon pisi turanicum Mordwilko.
Aphis bakeri Cowen.
Aphis medicaginis Koch.
Chaitophorus maculatus Buckton.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Myzocallis ononidis Kaltenbach.
Toxoptera graminum Rondani.

Melampyrum sp.
Anuraphis melampyri Del Guercio.

Melampyrum lineare=M. pratense.
Aphis melampyrum-latifolium Rafinesque.

Melandrum sylvestris.
Myzus lychnidis Linnaeus.

Melica bauhini.
Aphis avenae Fabricius.

Melica penicillaris.
Aphis avenae Fabricius.

Melilotus alba.
Aphis bakeri Cowen.
Aphis medicaginis Koch.
Aphis rumicis Linnaeus.
Macrosiphum pisi Kaltenbach.
Macrosiphum trifolii Pergande.
Myzocallis ononidis Kaltenbach.

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Melilotus officinalis.
Aphis medicaginis Koch.
Pemphigus bursarius Linnaeus.

Mentha aquatica.
Aphis menthae Walker.
Aphis rumicis Linnaeus.
Aphis tentans Walker.
Rhopalosiphum persicae Sulzer.

Mentha arvensis.
Aphis menthae Walker.
Aphis menthae-radicis Cowen.
Kaltenbachiella menthae Schouteden.
Macrosiphum menthae Buckton.
Rhizobius menthae Pesserini.

Mentha hirsuta.
Aphis menthae Walker.

Mentha longifolia.
Aphis capsellae Kaltenbach.

Mentha piperita.
Rhopalosiphum persicae Sulzer.

Mentha pulegium.
Aphis pulegi Del Guercio.

Mentha spicata=M. sylvestris.
Macrosiphum menthae Buckton.

Mentha sylvestris.
Aphis capsellae Kaltenbach.
Aphis clinipodii Passerini.
Kaltenbachiella menthae Schouteden.
Macrosiphum menthae Buckton.

Mentha viridis.
Aphis affinis Del Guercio.
Macrosiphum menthae Buckton.

Mentzelia sp.
Macrosiphum mentzeliae Wilson.

Menyanthes trifoliata.
Siphocoryne nymphaeae Linnaeus.

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Mesembrianthemum sp.
Rhopalosiphum persicae Sulzer.

Mimosa sp.
Aphis mimosae Ferrari.

Mimulus glabratus.
Aphis mimuli Oestlund.

Mimulus ringens.
Aphis mimuli Oestlund.

Monarda fistulosa.
Aphis monardae Oestlund.
Phorodon monardae Williams.

Monarda punctata.
Aphis monardae Oestlund.

Morus sp.
Aphis morae Kittel.
Aphis mori Clarke.

Muehlenbergia racemosa.
Anoecia corni Fabricius.
Toxoptera muhlenbergiae Davis.

Muehlenbergia schreberi.
Aphis setariae Thomas.

Mulgedium sp.
Macrosiphum rudbeckiae Fitch.

Musa ensete.
Aphis musae Schouteden.

Musa sapientium.
Pentalonia nigronervosa Coquerel.

Musenum tenuifolium.
Aphis pentstemonis Williams.

Myoporum "pictum".
Aphis myopori Macchiati.

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Myosotis palustris.
Aphis helichrysi Kaltenbach.
Aphis myosotidis Koch.
Aphis symphiti Schrank.

Myosotis scorpioides.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Myosotis sylvatica.
Aphis symphiti Schrank.

Myosotis weltwitschii.
Aphis myosotidis Koch.

Myrica gale.
Aphis myricae Kaltenbach.
Callipterus bellus Walsh.
Mybocallis coryli Goeze.

Myriophyllum verticellatum.
Siphocoryne nmyphaeae Linnaeus.

Myrtus sp.
Rhopalosiphum persicae Sulzer.

Najas flexilis.
Siphocoryne nymphaeae Linnaeus.

Narcissus sp.
Rhopalosiphum persicae Sulzer.

Nasturtium amphibium (Radicula).
Aphis nasturtii Kaltenbach.

Nasturtium austriacum (Radicula).
Aphis nasturtii Kaltenbach.

Nelumbium lutea.
Siphocoryne nymphaeae Linnaeus.
Macrosiphum nasturtii Koch.

Nemophila sp.
Macrosiphum convolvuli Kaltenbach.

Nepeta cataria.
Aphis nepetae Kaltenbach.

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Nepeta glechoma.
Aphis glechomae Walker.
Aphis gladioli Felt.

Nepeta hederacea=N. glechoma.
Aphis gossypii Glover.

Nephrolepis exaltata.
Idiapterus nephrelepidis Davis.

Nerium oleander.
Aphis asclepiadis Fitch.
Aphis lutescents Monell.
Aphis nerii Kaltenbach.
Aphis rumicis Linnaeus.
Aphis silybi Passerini.
Crytosiphum nerii Perez.
Myzus asclepiadis Passerini.
Myzus nerii Boyer.
Rhopalosiphum persicae Sulzer.

Nicotiana rustica.
Aphis scabiosae Scopoli.
Rhopalosiphum persicae Sulzer.

Nicotiana tabacum.
Macrosiphum tabaci Pergande.
Rhopalosiphum persicae Sulzer.

Nonnea sp.
Rhopalosiphum persicae Sulzer.

Nuphar.
Siphocoryne nymphaeae Linnaeus.

Nymphaea sp.
Aphis aquaticus Jackson.

Nymphaea alba.
Siphocoryne nymphaeae Linnaeus.

Nymphaea lutea=Nuphar lutea.
Siphocoryne nymphaeae Linnaeus.

Nymphaea odorata.
Siphocoryne nymphaeae Linnaeus.

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Nymphoides peltatum.
Siphocoryne nymphaeae Linnaeus.

Nyssa sylvatica=N. multiflora.
Phylloxera nyssae Pergande.

Oenanthe sp.
Aphis oenanthis Lichtenstein.

Oenothera sp.
Anoecia oenotherae Wilson.

Oenothera bertiana.
Aphis oenotherae Oestlund.
Myzus biennis Sanborn.
Myzus oenotherae Williams.
Pemphigus oenotherae Williams.

Oenothera biennis.
Aphis oenotherae Oestlund.
Myzus biennis Sanborn.
Myzus oenotherae Williams.

Oenothera caespitosa.
Aphis oenotherae Oestlund.

Oenothera serrulata.
Aphis oenotherae Oestlund.

Olea europea.
Eriosoma oleae Leach.

Onesma ferrea.
Greenidea artocarpi Westwood.

Onobrychis sp.
Macrosiphum pisi Kaltenbach.

Onobrychis viciaefolia.
Macrosiphum onobrychis Boyer.
Macrosiphum ulmariae Schrank.

Onoclea strutheopteris.
Amphorophora ampullata Buckton.

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Ononis calumnae.
Aphis brunnea Ferrari.

Ononis lurcina.
Macrosiphum pisi Kaltenbach.
Myzocallis ononidis Kaltenbach.

Ononis natrix.
Aphis apocyni Koch.
Aphis brunnea Ferrari.

Ononis repens.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Pergandeida ononidis Schouteden.

Ononis rotundifolia.
Macrosiphum ononis Koch.

Ononis spinosa.
Aphis brunnea Ferrari.
Aphis incumbens Walker.
Aphis inducta Walker.
Aphis translata Walker.
Macrosiphum ononis Koch.
Macrosiphum ulmariae Schrank.
Myzocallis ononidis Kaltenbach.

Onopordon acanthium.
Aphis cardui Linnaeus.
Aphis symphiti Schrank.
Macrosiphum sonchi Linnaeus.
Macrosiphum jaceae Linnaeus.
Rhopalosiphum persicae Sulzer
Trama troglodytes Heyden.

Onopordon illyricum.
Aphis cardui Linnaeus.
Aphis onopordi Schrank.
Macrosiphum sonchi Linnaeus.

Onosma stellulatum.
Aphis cardui Linnaeus.

Ophrys aranifera.
Aphis papaveris Fabricius.
Myzus cerasi Fabricius.

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Opulaster opulifolius.
Aphis avenae Fabricius.

Opuntia sp.
Rhopalosiphum persicae Sulzer.

Opuntia ficus-indica=O. tunica.
Aphis rumicis Linnaeus.

Orchidaceae.
Macrosiphum lutea Buckton.

Orchis coriophora
Aphis papaveris Fabricius.

Origanum panicupatum.
Aphis origani Passerini.

Origanum vulgare.
Aphis nepetae Kaltenbach.
Aphis origani Passerini.
Aphis rhamni Kaltenbach.

Ornithopus sp.
Aphis rumicis Linnaeus.

Orobanche sp.
Aphis middletoni Thomas.
Macrosiphum orobanches Lichtenstein.

Orobanche lutea.
Aphis orobanches Passerini.

Orobanche mutelli.
Aphis orobanches Passerini.

Orobanche ramosa.
Aphis candicans Passerini.
Aphis orobanches Passerini.
Aphis phelipaeae Passerini.

Orthocarpus.
Macrosiphum orthocarpus Davidson.

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Oryza sativa.
Pemphigus boyeri Passerini.
Pemphigus radicum Boyer.
Sipha glyceriae Kaltenbach.
Tetraneura ulmi Linnaeus.
Tychea setariae Passerini.
Tychea setulosa Passerini.

Osmaronia cerasiformis.
Illinoia osmaroniae Wilson.

Ostrya virginica.
Macrosiphum gerardiae Thomas.

Oxalis sp.
Aphis maidis Fitch.

Oxalis corniculata.
Aphis oxalis Macchiati.
Rhopalosiphum persicae Sulzer.

Oxalis rosea.
Macrosiphum circumflexa Buckton.
Rhopalosiphum persicae Sulzer.

Oxalis stricta=O. corniculata.
Aphis maidi-radicis Forbes.
Rhopalosiphum persicae Sulzer.

Oxybaphus angustifolius.
Aphis oxybaphi Oestlund.

Oxybaphus linearis=Alliaria linearis.
Aphis oxybaphi Oestlund.

Oxybaphus nyctagineus.
Aphis oxybaphi Oestlund.

Oxytropis lambertii.
Aphis medicaginis Koch.

Paliurium sp.
Aphis paliuri Lichtenstein.

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Panicum sp.
Amycla fuscifrons Koch.
Macrosiphum panicola Thomas.
Aphis maidi-radicis Forbes.
Colopha eragrostis Middleton.
Colopha ulmicola Fitch.

Panicum capillare.
Anoecia corni Fabricius.

Panicum dichotomiflorum=P. autumnale.
Anoecia corni Fabricius.
Aphis maidis Fitch.
Aphis setariae Thomas.
Rhizobius spicatus Hart.

Panicum miliaceum.
Endeis bella Koch.
Schizoneura venusta Passerini.

Panicum polyanthes.
Aphis seteriae Thomas.

Panicum proliferum.
Anoecia corni Fabricius.
Aphis setariae Thomas.
Rhizobius spicatus Hart.

Panicum teneriffae.
Tetraneura graminis Monell.

Papaver sp.
Aphis armata Hausmann.
Aphis aparines Kaltenbach.
Aphis balsamitae Müller.
Aphis thlaspeos Schrank.

Papaver dubium.
Aphis papaveris Fabricius.

Papaver hydrolapathum.
Aphis rumicis Linnaeus.

Papaver nudicaule.
Acyrthosiphon ilka Mordwilko.
Aphis papaveris Fabricius.

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Papaver rhoeas.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Papaver somniferum.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

"Papilionacearum".
Acyrthosiphon dubium Mordwilko.

Parietaria sp.
Aphis parietariae Lichtenstein.

Parietaria "effusa".
Aphis urticaria Kaltenbach.

Parietaria judaica.
Aphis urticae Fabricius.

Parietaria officinalis.
Aphis capsellae Kaltenbach.
Aphis scabiosae Scopoli.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.

Pasania densiflora=Quercus densiflora.
Myzocallis pasaniae Davidson.

Pastinaca sativa=Peucedanum sativum.
Aphis carotae Koch.
Aphis heraclii Cowen.
Aphis robusta Walker.
Aphis rumicis Linnaeus.
Aphis subterranea Walker.
Rhopalosiphum pastinaceae Koch.
Siphocoryne capreae Fabricius.
Siphocoryne foeniculi Passerini.
Siphocoryne pastinaceae Linnaeus.

Pedicularis palustris.
Aphis pedicularis Buckton.

Pelargonium sp.
Aphis extranea Walker.
Myzus targionii Del Guercio.

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Pelargonium zonale.
Macorsiphum pallida.
Macrosiphum pelargonii Kaltenbach.

Pellionia sp.
Toxoptera aurantii Boyer.

Pentapetes phoenicea.
Rhopalosiphum dianthi Schrank.

Pentstemon glaber.
Aphis pentstemonis Williams.

Pergularia extensa.
Aphis foveolata Del Guercio.

Periploca graeca.
Aphis nasturtii Kaltenbach.

"Persimmon".
Macrosiphum circumflexum Buckton.

Petasites albus.
Aphis lappae Koch.

Petasites japonicus.
Aphis petasitidis Buckton.
Phorodon galeopsidis Kaltenbach.

Petasites niveus.
Aphis petasitidis Buckton.

Petasites officinalis.
Aphis persicae Boyer.

Petroselinum hortense=Carum petroselinum.
Aphis rumicis Linnaeus.
Siphocoryne capreae Fabricius.

Peucedanum alsaticum.
Aphis rumicis Linnaeus.
Siphocoryne capreae Fabricius.

Peucedanum officinale.
Siphocoryne capreae Fabricius.

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Peucedanum typherr.
Aphis rumicis Linnaeus.

Phalaris arundinacea.
Aphis avenae Fabricius.
Aphis lonicerae Boyer.
Sipha glyceriae Kaltenbach.

Phalaris canariensis.
Toxoptera graminum Rondani.

Phaseolus sp.
Lachnus longitarsis Ferrari.
Macrosiphum ulmariae Schrank.

Phaseolus coccineus.
Aphis rumicis Linnaeus.
Tychea phaseoli Passerini.

Phaseolus lunatus.
Aphis gossypii Glover.

Phaseolus ranus.
Aphis gossypii Glover.

Phaseolus vulgaris.
Aphis gossypii Glover.
Aphis longirostris Fabricius.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Macrosiphum solanifolii Ashmead.
Tychea phaseoli Passerini.

Philadelphus coronarius.
Aphis gossypii Glover.
Aphis viburni Scopoli.

Philadelphus grandiflorus.
Aphis rumicis Linnaeus.

Phleum pratense.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Brachycolus tritici Gillette.
Geoica squamosa Hart.
Liosomaphis rhois Monell.
Sipha flavus Forbes.
Sipha glceriae Kaltenbach.
Toxoptera graminum Rondani.

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Photinea serratula.
Myzus cerasi Fabricius.

Phragmites sp.
Hyalopterus pruni Fabricius.

Phragmites communis.
Aphis phragmitidicola Oestlund.
Hyalopterus arundinus Fabricius.
Stenaphis monticellii Del Guercio.

Phragmites vulgaris.
Hyalopterus arundinus Fabricius.

Phyllostachys sp.
Aphis bambusae Fullaway.

Physalis sp.
Macrosiphum solanifolii Ashmead.

Physalis peruviana.
Macrosiphum circumflexa Buckton.

Physocarpus opulifolius=Neillia opulifolia.
Aphis neilliae Oestlund.
Picea sp.

Chermes abieticolens Thomas.
Chermes piceae Ratzeburg.
Chermes viridis Ratzeburg.
Dreyfusia nüsslini Börner.
Pemphigus piceae Hartig.
Prociphilus xylostei DeGeer.

Picea abies=P. excelsa.
Aphis pilicornis Hartig.
Chermes abietis Linnaeus.
Chermes coccineus Ratzeburg.
Chermes coniferarum Cholodkovsky.
Chermes funitectus Dreyfus.
Chermes lapponicus Cholodkovsky.
Chermes lapponicus praecox Cholodkovsky.
Chermes orientalis Dreyfus.
Chermes pictinatae Cholodkovsky.
Chermes picaeae bouvieri Cholodkovsky.
Chermes pini Macquart.

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Chermes pini pineoides Cholodkovsky.
Chermes pini pinicola Cholodkovsky.
Chermes sibiricus Cholodkovsky.
Chermes similis Gillette.
Chermes strobilobius Kaltenbach.
Chermes tardus Dreyfus.
Chermes viridanus Cholodkovsky.
Chermes viridis lutescens Cholodkovsky.
Cnaphalodes affinis Börner.
Eulachnus macchiati Del Guercio.
Lachnus abietis Fitch.
Lachnus abietis Walker.
Lachnus bogdanowi Mordwilko.
Lachnus farinosus Cholodkovsky.
Lachnus fusciata Burmeister.
Lachnus flavus Mordwilko.
Lachnus grossus Kaltenbach.
Lachnus hyalinus Koch.
Lachnus macrocephalus Buckton.
Lachnus piceae Panzer.
Lachnus piceicola Cholodkovsky.
Lachnus piceicola viridescens Cholodkovsky.
Lachnus pinicola Kaltenbach.
Macrosiphum piceaella Theobald.
Mindarus abietinus Koch.
Myzaphis abietina Walker.
Pterochlorus roboris Linnaeus.

Picea alba.
Chermes abietis Linnaeus.
Chermes lapponicus Cholodkovsky.
Chermes lapponicus praecox Cholodkovsky.
Chermes pinifoliae Fitch.
Chermes strobi Hartig.
Chermes strobilobius Kaltenbach.
Cehrmes viridanus Cholodkovsky.
Lachnus abieticola Cholodkovsky.
Lachnus abietis Fitch.
Lachnus piceae Panzer.
Myzaphis abietina Walker.
Schizoneura obliqua Cholodkovsky.

Picea canadensis=Tsuga canadensis?
Chermes laricíatus Patch.
Chermes similis Gillette.
Chermes strobilobius Kaltenbach.
Lachnus abietis Fitch.
Minarus abietinus Koch.
Schizoneura obliqua Cholodkovsky.

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Picea englemanni.
Chermes cooleyi Gillette.
Chermes cooleyi coweni Gillette.
Chermes lapponicus Cholodkovsky.
Chermes lapponicus praecox Cholodkovsky.
Chermes strobilobius Kaltenbach.
Myzaphis abietina Walker.

Picea gigantea.
Myzaphis abietina Walker.

Picea glauca.
Lachnus farinosus Cholodkovsky.

Picea kosteriana.
Myzaphis abietina Walker.

Picea glehire.
Myzaphis abietina Walker.

Picea glehni.
Lachnus glehnus Essig.

Picea mariana.
Aphis gallarum De Geer.
Chermes abietis Linnaeus.
Chermes consolidatus Patch.
Chermes floccus Patch.
Chermes pinifoliae Fitch.
Chermes similis Gillette.
Chermes strobilobius Kaltenbach.
Lachnus abieticola Cholodkovsky.
Lachnus abietis Fitch.
Lachnus costata Zetterstedt.
Lachnus fasciatus Burmeister.
Mindarus abietinus Koch.
Myzaphis abietina Walker.

Picea monstrosa.
Myzaphis abietina Walker.

Picea morinda.
Chermes abietis-piceae Stebbing.
Chermes himalayensis Stebbing.
Myzaphis abietina Walker.

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Picea obovata.
Chermes viridanus Cholodkovsky.

Picea omorika.
Myzaphis abietina Walker.

Picea orientalis.
Chermes orientalis Dreyfus.
Chermes pini Marquart.
Chermes pini pineoides Cholodkovsky.
Chermes sibiricus Cholodkovsky.
Chermes strobilobius Kaltenbach.
Myzaphis abietina Walker.

Picea pungens.
Chermes cooleyi Gillette.
Chermes montanus Gillette.
Chermes similis Gillette.
Chermes strobilobius Kaltenbach.
Lachnus farinosus Cholodkovsky.
Myzaphis abietina Walker.

Picea rubra=P. nigra.
Chermes consolidatus Patch.
Chermes floccus Patch.
Chermes pinifoliae Fitch.
Chermes similis Gillette.
Myzaphis abietina Walker.

Picea sitchensis.
Myzaphis abietina Walker.
Rhizobius viridis Theobald.

Picridum vulgare.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.

Picris sp.
Aphis rumicis Linnaeus.

Picris echioides.
Aphis terricola Rondani.
Rhopalosiphum lactucae Kaltenbach.

Picris hieracioides.
Aphis terricola Rondani.
Macrosiphum picridis Fabricius.
Macrosiphum sonchi Linnaeus.
Rhopalosiphum lactucae Kaltenbach.

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Piltasporum tobira.
Aphis sambuci Linnaeus.

Pimelea sp.
Aphis anthrisci Kaltenbach.
Rhopalosiphum persicae Sulzer.

Pimpinella magna.
Aphis pimpinellae Kaltenbach.
Siphocoryne pastinaceae Linnaeus.

Pimpinella saxifraga.
Aphis pimpinellae Kaltenbach.
Siphocoryne pastinaceae Linnaeus.

Pinus sp.
Chaitophorus pinicolens Fitch.
Chermes coccineus Ratzeburg.
Chermes lapponicus Cholodkovsky.
Chermes obtectus Ratzeburg.
Chermes pini pineoides Cholodkovsky.
Chermes viridis Ratzeburg.
Cnaphalodes affinis Börner.
Essigella californicus Essig.
Lachnus farinosus Cholodkovsky.
Lachnus grossus Kaltenbach.
Lachnus hyalinus Koch.
Lachnus oregonensis Wilson.
Lachnus pineus curtipilosa Mordwilko.
Lachnus piniphila Ratzeburg.
Lachnus taeniatoides Mordwilko.
Pemphigus degeeri Kaltenbach.
Pemphigus piceae Hartig.
Prociphilus bumeliae Schrank.
Prociphilus poschingeri Holzner.
Protolachnus tuberculostemmata Theobald.
Schizoneura costata Hartig.

Pinus cembra.
Chermes abietis Linnaeus.
Chermes cembrae Cholodkovsky.
Chermes sibiricus Cholodkovsky.
Lachnus pini cembrae Cholodkovsky.
Lachnus pini Linnaeus.
Lachnus taeniatus Koch.

Pinus contorta.
Chermes coloradensis Gillette.

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Pinus echinata.
Aphis marginipennis Haldeman.

Pinus edulis.
Chermes coloradensis Gillette.

Pinus halepensis.
Lachnus agalis Kaltenbach.
Lachnus pini Linnaeus.

Pinus insignis.
Chermes pini Koch.
Lachnus pini-radiatae Davidson.
Mindarus pinicola Thomas.

Pinus laricio.
Chermes pinicorticis Fitch.
Schizoneura fuliginosa Buckton.

Pinus "maritima".
Lachnus hyperophilus Koch.
Lachnus pineti Fabricius.
Lachnus pineus Mordwilko.
Lachnus taeniatus Koch.

Pinus "montanum".
Chermes pini Macquart.
Chermes pini Koch.
Chermes pini pinicola Cholodkovsky.

Pinus "mughus".
Lachnus pinicola Kaltenbach.

Pinus "orientalis".
Chermes orientalis Dreyfus.

Pinus palustris.
Lachnus autralis Ashmead.

Pinus pinaster.
Chermes pinicorticis Fitch.
Lachnus agilis Kaltenbach.
Lachnus tomentosus Linneaus.

Pinus "pinastu-maritima".
Chermes pinicorticis Fitch.

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Pinus pinea.
Chermes pini Macquart.
Eulachnus abamelekí Del Guercio.
Eulachnus macchiati Del Guercio.

Pinus ponderosa.
Chermes coloradensis Gillette.
Lachnus flocculosa Williams.
Lachnus pini Linnaeus.
Lachnus ponderosa Williams.
Mindarus pinicola Thomas.

Pinus pumilio.
Chermes pini Koch.

Pinus pyrenaica.
Schizoneura fuliginosa Buckton.

Pinus rigida.
Lachnus parvus Wilson.

Pinus scopulorum.
Chermes coloradensis Gillette.
Lachnus pini Linnaeus.

Pinus serotina.
Lachnus australis Ashmead.

Pinus strobus.
Chermes corticalis Kaltenbach.
Chermes floccus Patch.
Chermes lariciatus Patch.
Chermes orientalis Dreyfus.
Chermes pinicorticis Fitch.
Chermes pinifoliae Fitch.
Chermes sibiricus Cholodkovsky.
Chermes strobi Hartig.
Lachnus fasciatus Burmeister.
Lachnus pineus Mordwilko.
Lachnus rileyi Williams.
Lachnus strobi Fitch.
Lachnus taeniatoides Mordwilko.
Mindarus pinicola Thomas.

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Pinus sylvestris.
Chermes abietis Linnaeus.
Chermes corticalis Kaltenbach.
Chermes orientalis Dreyfus.
Chermes pini Koch.
Chermes pini Macquart.
Chermes pini pinicola Cholodkovsky.
Chermes pinicorticis Fitch.
Chermes sibiricus Cholodkovsky.
Chermes strobilobius Kaltenbach.
Eulachnus abameleki Del Guercio.
Eulachnus mingazinii Del Guercio.
Eulachnus nigrofasciatus Del Guercio.
Glyphina pilosa Buckton.
Lachniella oblonga Del Guercio.
Lachniella picta Del Guercio.
Lachnus agilis Kaltenbach.
Lachnus fasciatus Burmeister.
Lachnus hyperophilus Koch.
Lachnus maculosus Cholodkovsky.
Lachnus pineti Fabricius.
Lachnus pineus Mordwilko.
Lachnus pini Linnaeus.
Lachnus pinicola Kaltenbach.
Lachnus pinihabitans Mordwilko.
Lachnus rileyi Williams.
Lachnus taeniatus Koch.
Lachnus tomentosus Linnaeus.
Pterochlorus roboris Linnaeus.
Rhizobius pini Burmeister.
Schizoneura fuliginosa Buckton.

Pinus virginiana=P. inops.
Lachnus parvus Wilson.

Piper sp.
Aphis piperis Kittel.

Pistacia atlantica.
Ceratopemphigus zehntneri Schouteden.
Pemphigus riccobonii Steffani.

Pistacia lentiscus.
Aploneura lentisci Passerini.
Pemphigus pistaciae Linnaeus.
Pemphigus retroflexus Courchet.

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Pistacia terebinthus.
Pemphigus cornicualrius Passerini.
Pemphigus derbesi Lichtenstein.
Pemphigus edifactor Buckton.
Pemphigus follicularius Passerini.
Pemphigus minor Derbes.
Pemphigus pallidus Derbes.
Pemphigus pistaciae Linnaeus.
Pemphigus semilunarius Passerini.
Pemphigus utricularius Passerini.
Tetraneura pallida Haliday.
Tetraneura ulmi Linnaeus.

Pistacia vera.
Pemphigus coccus Buckton.
Pemphigus pistaciae Linnaeus.

Pisum sp.
Acyrthosiphum pisi destructor Mordwilko.
Aphis rumicis Linnaeus.

Pisum arvense.
Macrosiphum nigrinectaria Theobald.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Pisum sativum.
Macrosiphum destructor Johnson.
Macrosiphum pisi Kaltenbach.
Macrosiphum solanifolii Ashmead.
Macrosiphum ulmariae Schrank.

Planera sp.
Eriosoma lanigera Hausmann.
Schizoneura lanuginosa Hartig.

Plantago aristata=P. patagonica.
Aphis maidi-radicis Forbes.

Plantago coronopus.
Aphis dauci Fabricius.
Myzus plantagineus Passerini.

Plantago lanceolata.
Aphis plantaginis Schrank.
Phorodon galeopsidis Kaltenbach.
Rhopalosiphum persicae Sulzer.

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Plantago major.
Aphis dauci Fabricius.
Aphis maidi-radicis Forbes.
Aphis myosotidis Koch.
Aphis plantaginis Schrank.
Aphis sorbi Kaltenbach.
Myzus plantagineus Passerini.

Plantago media.
Aphis dauci Fabricius.
Aphis plantaginis Schrank.
Myzus plantagineus Passerini.

Plantago psyllium.
Phorodon galeopsidis Kaltenbach.

Plantago rugelli.
Aphis dauci Fabricius.
Aphis maidi-radicis Forbes.

Plantago virginica.
Aphis gossypii Glover.

Platanus sp.
Aphis acericola Walker.
Myzus gracilis Buckton.

Platanus occidentalis.
Aphis quercifoliae Walsh.
Drepanosiphum platanoides Schrank.
Lachnus platani Kaltenbach.
Lachnus plantanicola Riley.
Longistigma caryae Harris.

Poa sp.
Anoecia willcocksi Theobald.
Aphis poae Hardy.
Macrosiphum dirhoda Walker.
Rhopalosiphum persicae Sulzer.
Schizoneura venusta Passerini.

Poa annua.
Aphis annuae Oestlund.
Aphis avenae Fabricius.
Endies pellucida Buckton.
Geoica squamosa Hart.

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Macrosiphum cerealis Kaltenbach.
Macrosiphum longipennis Buckton.
Macrosiphum poae Macchiati.
Rhizobius poae Thomas.
Rhizobius poae Buckton.
Sipha glyceriae Kaltenbach.
Toxoptera graminum Rondani.
Tychea eragrostidis Passerini.
Tychea trivialis Passerini.

Poa compressa.
Aphis annuae Oestlund.
Aphis avenae Fabricius.
Macrosiphum granarium Kirby.
Rhopalosiphum dianthi var. poae Williams.
Toxoptera graminum Rondani.

Poa pratensis.
Aphis avenae Fabricius.
Forda formicaria Heyden.
Forda occidentalis Hart.
Geoica squamosa Hart.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Pemphigus boyeri Passerini.
Rhopalosiphum poae Gillette.
Schizoneura panicola Thomas.
Sipha flavus Forbes.
Toxoptera graminum Rondani.
Tychea erigeronensis Thomas.
Tychea trivialis Passerini.

Poa trivialis.
Aphis avenae Fabricius.
Tychea trivialis Passerini.

Polanasia graveolens=Cleome graveolens.
Aphis polanisiae Oestlund.
Aphis polanisia-graveolens Rafinesque.

Polyanthus tuberosa.
Aphis polyanthis Sulzer.
Aphis tuberosae Boyer.
Rhopalosiphum persicae Sulzer.

Polygala senega.
Aphis polygala-senega Rafinesque.

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Polygonum sp.
Amycla albicornis Koch.
Macrosiphum granarium Kirby.
Schizoneura panicola Thomas.
Siphocoryne nymphaeae Linnaeus.

Polygonum aviculare.
Anoecia corni Fabricius.
Aphis polygoni Macchiati.
Aphis polygoni Walker.
Pemphigus betae Doane.
Phorodon galeopsidis Kaltenbach.
Sipha polygoni Schouteden.

Polygonum cristatum.
Macrosiphum venaefuscae Davis.

Polygonum "donii".
Phorodon galeopsidis Kaltenbach.

Polygonum fagopyrum=Fagopyrum sp.
Aphis polygoni Van Der Goot.
Aphis rumicis Linnaeus.
Phorodon galeopsidis Kaltenbach.

Polygonum hydropiper.
Phorodon galeopsidis Kaltenbach.

Polygonum hydropiperoides.
Aphis maidi-radicis Forbes.
Phorodon galeopsidis Kaltenbach.

Polygonum incarnatum.
Aphis maidi-radicis Forbes.

Polygonum lapthifolium.
Aphis maidi-radicis Forbes.
Phorodon galeopsidis Kaltenbach.

Polygonum mite.
Phorodon galeopsidis Kaltenbach.

Polygonum muhlenbergii.
Aphis maidi-radicis Forbes.

Polygonum nodosum.
Aphis polygoni Van Der Goot.
Rhopalosiphum hippophaës Koch.

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Polygonum pennsylvanicum.
Anoecia corni Fabricius.
Aphis maidis Fitch.
Phorodon galeopsidis Kaltenbach.

Polygonum persicaria.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Aphis maidi-radicis Forbes.
Aphis maidis Fitch.
Aphis rumicis Linnaeus.
Aphis transiens Walker.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum polygoni Buckton.
Phorodon galeopsidis Kaltenbach.
Rhopalosiphum hippophaës Koch.
Rhopalosiphum persicae Sulzer.

Polymnia canadensis.
Macrosiphum circumflexa Buckton.

Polypogon monspeliensis.
Toxoptera graminum Rondani.

Polystichum sp.
Amphorophora ampullata Buckton.

Pontederia cordata.
Siphocoryne nymphaeae Linnaeus.

Populus sp.
Aphis amenticola Kaltenbach.
Chaitophorus albus Mordwilko.
Longistigma caryae Harris.
Pemphigus globulosus Theobald.
Pembhigus lactucarius Passerini.
Pemphigus lichtensteini Tullgren.
Pemphigus napaeus Buckton.
Pemphigus spyrothecae infaustus Ferrari.
Pemphigus varsoviensis Mordwilko.
Pterocomma populeus longirostris Mordwilko.
Pterocomma rufulus Davidson.
Pterocomma steinheili Mordwilko.

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Populus alba.

Aphis longirostris Fabricius.
Arctaphis populi Linnaeus.
Asiphum tremulae Linnaeus.
Chaitophorus leucomelas Koch.
Chaitophorus salicti Schrank.
Chermes populi Del Guercio.
Pachypapa marsupialis Koch.
Pachypapa vesicalis Koch.
Pemphigus filaginis Boyer.
Pterocomma populea Katlenbach.
Schizoneura passerinii Signoret.

Populus angustifolia.

Chaitophorus populicola Thomas.
Cornaphis populi Gileltte.
Schizoneura populi Gillette.
Thecabius populi-monilis Riley.

Populus balsamifera.

Anuraphis populi Del Guercio.
Chaitophorus candicans Thomas.
Chaitophorus populicola Thomas.
Chaitophorus populifoliae (Oestlund) Davis.
Mordwilkoja vagabunda Walsh.
Pemphigus balsamiferae Williams.
Pemphigus gravicornis Patch.
Pemphigus popularia Fitch.
Thecabius populi-conduplifolius Cowen.
Pamphigus populi-globuli Fitch.
Pemphigus populi-ramulorum Riley.
Pemphigus populi-transversus Riley.
Pemphigus populi-venae Fitch.
Pterocomma bicolor Oestlund.
Schizoneura populi Gillette.
Stagona vesicalis Rudow.
Thecabius patchii Gillette.
Thecabius populicaulis Fitch.
Thecabius populi-monilis Riley.

Populus candicans=P. alba.

Asiphum pseudobyrsa Walsh.
Chaitophorus candicans Thomas.
Pterocomma salicis Linnaeus.

Populus canadensis.

Chaitophorus leucomelas Koch.
Pemphigus canadensis Del Guercio.

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Populus ciliata.
Pemphigus imaicus Cholodkovsky.
Pemphigus mordwilkoi Cholodkovsky.
Pemphigus nainitalensis Cholodkovsky.

Populus coccinea.
Asiphum pseudobyrsa Walsh.

Populus deltoides=P. monilifera.
Aphis populifoliae Fitch.
Asiphum pseudobyrsa Walsh.
Chaitophorus populicola Thomas.
Chaitophorus stevensis Sanborn.
Mordwilkoja vagabunda Walsh.
Pemphigus betae Doane.
Pemphigus bursarius Linnaeus.
Pemphigus oestlundi Cockerell.
Pemphigus populi-ramulorum Riley.
Pemphigus populi-transversus Riley.
Phylloxera popularia Pergande.
Phylloxera prolifera Oestlund.
Pterocomma salicti Harris.
Schizoneura populi Gillette.
Thecabius populicaulis Fitch.
Thecabius populi-conduplifolius Cowen.
Thecabius populi-monilis Riley.

Populus deltoides-angustifolia.?
Chaitophorus populicola Thomas.
Thecabius populi-monilis Riley.

Populus fremonti.
Aphis populifoliae Fitch.
Asiphum pseudobyrsa Walsh.
Chaitophorus populicola Thomas.
Pemphigus oestlundi Cockerell.
Pemphigus populi-ramulorum Riley.
Pemphigus populi-transversus Riley.
Phylloxera popularia Pergande.
Phylloxera prolifera Oestlund.
Thecabius populicaulis Fitch.
Thecabius populi-monilis Riley.

Populus grandidentata.
Aphis populifoliae Fitch.
Aphis populi-grandidentata Rafinesque.
Arctaphis populi Linnaeus.
Chaitophorus populifoliae (Oestlund) Davis.

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Populus italica.

Chaitophorus leucomelas Koch

Populus monilifera.

Chaitophorus populicola Thomas.
Chaitophorus stevensis Sanborn.
Mordwilkoja vagabunda Walsh.
Pemphigus bursarius Linnaeus.
Pemphigus flaginis Boyer.
Pemphigus populi-transversus Riley.
Thecabius affinis Kaltenbach.
Thecabius populi-conduplifolius Cowen.
Thecabius populi-monilis Riley.

Populus nigra.

Abamalekia lazarewi Del Guercio.
Anuraphis populi Del Guercio.
Aphis longirostris Fabricius.
Aphis populeti Panzer.
Arctaphis populi Linnaeus.
Chaitophorus leucomelas Koch.
Chaitophorus leucomelas lyratus Ferrari.
Chaitophorus nassonowi Mordwilko.
Chaitophorus versicolor Koch.
Drepanosiphum smaragdinum Koch.
Drepanosiphum tiliae Koch.
Lachnus viminalis Boyer.
Pachypapa marsupialis Koch.
Pachypapa vesicalis Koch.
Pemphigus borealis Tullgren.
Pemphigus bursarius Linnaeus.
Pemphigus canadensis Del Guercio.
Pemphigus flaginis Boyer.
Pemphigus ovata-oblongus Kessler.
Pemphigus populi Courchet.
Pemphigus protospirae Lichtenstein.
Pemphigus pyriformis Lichtenstein.
Pemphigus spyrothecae Passerini.
Pemphigus tortuosis Rudow.
Pemphigus vesicarius Passerini.
Pterocomma populea Kaltenbach.
Stagona vesicalis Rudow.
Stomaphis bobretzkyi Mordwilko.
Thecabius affinis Kaltenbach.
Thecabius populicaulis Fitch.
Thecabius populneus Koch.

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Populus pyramidalis.

Aphis populeti Panzer.
Arctaphis populi Linnaeus.
Asiphum tremulae Linnaeus.
Chaitophorus leucomelas Koch.
Chaitophorus nassonowi Mordwilko.
Drepanosiphum smaragdinum Koch.
Drepanosiphum tiliae Koch.
Pachypappa marsupialis Koch.
Pemphigus borealis Tullgren.
Pemphigus bursarius Linnaeus.
Pemphigus flaginis Boyer.
Pemphigus gladiformis Rudow.
Pemphigus ovato-oblongus Kessler.
Pemphigus protospirae Lichtenstein.
Pemphigus pyriformis Lichtenstein.
Pemphigus spyrothecae Passerini.
Pterocomma populea Kaltenbach.
Thecabius affinis Kaltenbach.
Thecabius populicaulis Fitch.

Populus tremula.

Arctaphis populi Linnaeus.
Asiphum tremulae Linnaeus.
Chaitophorus betulinus Van Der Goot.
Chaitophorus tremulae Koch.
Chaitophorus versicolor Koch.
Pachypapa lactea Tullgren.
Pachypapa vesicalis Koch.
Pemphigus bursarius Linnaeus.
Stagona vesicalis Rudow.

Populus tremuloides.

Aphis populus-trepida Rafinesque.
Arctaphis populi Linnaeus.
Asiphum sacculi Gillette.
Chaitophorus bruneri Williams.
Chaitophorus delicata Patch.
Chaitophorus populicola Thomas.
Chaitophorus populifolae (Oestlund) Davis.
Pemphigus immunis Buckton.
Pemphigus? rileyi Stebbins.
Pterocomma beulahensis Cockerell.
Thecabius populicaulis Fitch.
Thecabius populi-monilis Riley.

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Populus trichocarpa.
Chaitophorus populicola Thomas.
Chaitophorus salicicola Essig.
Eichochaitophorus populifolii Essig.
Pemphigus populi-transversus Riley.
Phylloxera populicaria Pergande.
Thecabius populicaulis Fitch.
Thecabius populi-conduplifolius Cowen.
Thecabius populimonilis Riley.

Portulaca sp.
Rhopalosiphum persicae Sulzer.

Portulaca oleracea.
Aphis gossypii Glover.
Aphis laburni Kaltenbach.
Aphis maidi-radicis Forbes.
Myzus portulacae Macchiati.

Potamogeton crispus.
Siphocoryne numphaeae Linnaeus.

Potamogeton natans.
Rhopalosiphum najadum Koch.
Siphocoryne nymphaeae Linnaeus.

Potamogeton pectinatus.
Siphocoryne nymphaeae Linnaeus.

Potentilla anserina.
Aphis potentillae Walker.
Macrosiphum potentillae Oestlund.
Myzus potentillae Oestlund.
Myzus potentillae Williams.
Myzus rosarum Kaltenbach.
Phorodon galeopsidis Kaltenbach.

Potentilla arguta.
Myzus potentillae Williams.

Potentilla hippiana.
Macrosiphum martini Cockerell.

Potentilla reptans.
Phorodon galeopsidis Kaltenbach.

Potentilla recta.
Rhopalosiphum persicae Sulzer.

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Potentilla tormentilla.
Aphis tormentilliae Passerini.

Potentilla verna.
Phorodon galeopsidis Kaltenbach.

Prenanthes alba.
Rhopalosiphum nabali Oestund.

Primula forbesi.
Rhopalosiphum persicae Sulzer.

Primula kewensis.
Macrosiphum primulae Theobald.

Primula "veris".
Aphis furcipes Rafinesque.

Primula vulgaris.
Macrosiphum primulae Theobald.
Rhopalosiphum persicae Sulzer.

Pritchardia sp.
Cerataphis lataniae Boisduval.

Prunella vulgaris.
Aphis brunellae Schouteden.

Prunus sp.
Aphis prunicoleus Ashmead.
Aphis prunifoliae Fitch.
Aphis prunorum Dobrowljansky.
Aphis setariae Thomas.
Dryobius amygdali Van Der Goot.
Phorodon pruni Scopoli.
Schizoneura vagans Koch.
Tetraneura pruni Taschenberg.

Prunus americana.
Rhopalosiphum persicae Sulzer.

Prunus amygdalus.
Aphis amygdali (Balnchard) Boisduval.
Aphis amygdalinus Schouteden.
Aphis persicae Boyer.
Hyalopterus pruni Fabricius.
Lachnus persicae Cholodkovsky.
Rhopalosiphum persicae Sulzer.
Tetraneura africana Van Der Goot.

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Prunus armeniaca.
Aphis persicarae Hartig.
Aphis pruni Koch.
Hyalopterus arundinis Fabricius.
Hyalopterus pruni Fabricius.
Lachnus fuliginosus Buckton.
Rhopalosiphum persicae Sulzer.

Prunus avium.
Aphis cerasicolens Fitch.
Aphis cerasifoliae Fitch.
Aphis cerasina Walker.
Aphis sorbi Kaltenbach.
Myzus cerasi Fabricius.

Prunus cerasus.
Aphis cerasi Schrank.
Myzus cerasi Fabricius.
Rhopalosiphum persicae Sulzer.

Prunus chamaecerasus.
Aphis mahaleb Koch.
Myzus oxycanthae Schrank.

Prunus chicasa.
Aphis persicae-niger Smith.

Prunus domestica.
Anoecia corni Fabricius.
Aphis alemedensis Clarke.
Aphis cerasi Schrank.
Aphis convecta Walker.
Aphis detracta Walker.
Aphis diversa Walker.
Aphis egressa Walker.
Aphis internata Walker.
Aphis lateralis Walker.
Aphis persicae Boyer.
Aphis persicariae Hartig.
Aphis persorbens Walker.
Aphis prunaria Walker.
Aphis pruni Koch.
Aphis prunicola Kalt.
Aphis prunina Walker.
Aphis pyri Boyer.
Aphis similis Walker.
Aphis transposita Walker.

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Eriosoma lanigera Hausmann.
Hyalopterus arundinus Fabricius.
Hyalopterus pruni Fabricius.
Myzus cerasi Fabricius.
Phorodon humuli Schrank.
Rhopalosiphum persicae Sulzer.
Siphocoryne nymphaeae Linnaeus.

Prunus insititia.
Aphis helichrysi Kaltenbach.
Aphis insititiae Koch.
Aphis persicae Boyer.
Aphis pruni Koch.
Hyalopterus arundinus Fabricius.
Hyalopterus pruni Fabricius.
Phorodon humuli Schrank.

Prunus mahaleb.
Aphis mahaleb Koch.
Myzus cerasi Fabricius.
Phorodon humuli Schrank.
Phorodon pruni Ferrari.

Prunus melanocarpa.
Rhopalosiphum persicae Sulzer.

Prunus "nigra".
Aphis cardui Linnaeus.
Aphis cerasifoliae Fitch.

Prunus padus.
Aphis avenae Fabricius.
Aphis padi Linnaeus.
Aphis pruni Koch.
Lachnus padi Hartig.

Prunus pennsylvanica.
Aphis cerasifoliae Fitch.

Prunus persica.
Aphis cerasi Schrank.
Aphis persicae Boyer.
Aphis persicae Koch.
Aphis persicae Kaltenbach.
Aphis persicaecola Boisduval.
Aphis persicariae Hartig.
Aphis persicae-niger Smith.

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Aphis persicarum Boisduval.
Aphis persicophila Passerini.
Aphis prunicola Kaltenbach.
Hyalopterus arundinus Fabricius.
Hyalopterus pruni Fabricius.
Lachnus fuliginosus Buckton.
Myzus cerasi Fabricius.
Myzus persicae Passerini.
Rhopalosiphum dubia Curtis.
Rhopalosiphum lactucellum Theobald.
Rhopalosiphum persicae Sulzer.

Prunus pissardi=Prunus divaricata.
Hyalopterus pruni Fabricius.
Phorodon humuli Schrank.

Prunus serotina.
Aphis avenae Fabricius.
Aphis cerasicolens Fitch.
Aphis cerasifoliae Fitch.
Aphis tuberculata Patch.
Myzus cerasi Fabricius.
Rhopalosiphum persicae Sulzer.

Prunus spinosa.
Aphis bellula Walker.
Aphis cerasi Schrank.
Aphis consona Walker.
Aphis conviva Walker.
Aphis infuscata Koch.
Aphis nociva Walker.
Aphis persicae Boyer.
Aphis prunaria Walker.
Aphis pruni Koch.
Aphis prunicola Kaltenbach.
Aphis prunina Walker.
Aphis spinarum Hartig.
Aphis transmutata Walker.
Hyalopterus arundinis Fabricius.
Hyalopterus pruni Fabricius.
Phorodon humuli Schrank.
Rhopalosiphum persicae Sulzer.

Prunus virginiana.
Aphis avenae Fabricius.
Aphis cerasifoliae Fitch.
Aphis furcata Patch.

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Psedera quinquefolia=Parthenocissus 5-folius.
Aphis folsomii Davis.
Aphis parthenocissi Williams.
Aphis setariae Thomas.

Pseudotsuga douglassi.
Chermes cooleyi Gillette.
Chermes cooleyi coweni Gillette.
Lachnus pseudotsugae Wilson.
Prociphilus fraxini-dipetalae Essig.

Pteris aquilina.
Aphis pteris-aquilinoides Rafinesque.
Mastopoda pteridis Oestlund.
Macrosiphum pteridis Wilson.

Puccinellia distans=Glyceria distans.
Endeis rorea Koch.

Pulicaria sp.
Phorodon inulae Passerini.

Pulmonaria officnalis.
Macrosiphum jaceae Linnaeus.

Punica granatum.
Aphis punicae Passerini.
Aphis punicella Theobald.

Punica sylvestris.
Aphis punicae Passerini.

Pyrus sp.
Aphis kochi Schouteden.
Eriosoma pyri Westwood.

Pyrus americana.
Aphis pomi DeGeer.
Eriosoma lanigera Hausmann.

Pyrus aucuparia.
Aphis aucupariae Buckton.
Aphis padi Linnaeus.
Aphis pomi De Geer.
Aphis sorbi Kaltenbach.

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Pyrus communis.

Aphis avenae Fabricius.
Aphis bakeri Cowen.
Aphis crataegi Kaltenbach.
Aphis gossypii Glover.
Aphis lentiginis Buckton.
Aphis oxycanthae Koch.
Aphis pomi De Geer.
Aphis prunina Walker.
Aphis pyrastri Boisduval.
Aphis pyri Boyer.
Aphis pyri Koch.
Aphis rumicis Linnaeus.
Aphis sorbi Kaltenbach.
Eriosoma lanigera Hausmann.
Eriosoma pyricola Baker & Davidson.
Lachnus pyri Buckton.
Macrosiphum tabaci Pergande.
Myzus oxycanthae Schrank.
Myzus pyrarius Passerini.
Myzus pyrinus Ferrari.
Phylloxera piri Cholodkovsky.
Prociphilus pyri Fitch.
Rhopalosiphum persicae Sulzer.
Schizoneura piri (Giethe) Mordwilko.

Pyrus coronaria.

Aphis gossypii Glover.
Aphis pyri Boyer.
Eriosoma lanigera Hausmann.

Pyrus germanica.

Aphis assidua Walker.
Aphis avenae Fabricius.
Aphis fichtii Sanderson.
Aphis inserta Walker.
Aphis insita Walker.
Aphis mactata Walker.
Aphis nutricata Walker.
Aphis padi Linnaeus.
Aphis pomi De Geer.
Aphis pyri Boyer.
Macrosiphum pelargonii Kaltenbach.
Ovatus mespili Van Der Goot.

Pyrus japonica.

Aphis brevis Sanderson.

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Pyrus malus.

Aphis aucupariae Buckton.
Aphis avenae Fabricius.
Aphis bakeri Cowen.
Aphis brevis Sanderson.
Aphis crataegi Kaltenbach.
Aphis devecta Walker.
Aphis fitchii Sanderson.
Aphis mali Fabricius.
Aphis malifoliae Fitch.
Aphis (myzus) nigra Theobald.
Aphis padi Linnaeus.
Aphis pomi De Geer.
Aphis pyri Hartig.
Aphis pyri Boyer.
Aphis sorbi Kaltenbach.
Eriosoma lanigera Hausmann.
Euceraphis mucidus Fitch.
Hyalopterus pruni Fabricius.
Lachnus viminalis Boyer.
Macrosiphum solanifolii Ashmead.
Macrosiphum tabaci Pergande.
Myzus mali Ferrari.
Myzus oxycanthae Schrank.
Pemphigus americanus Walker.
Prociphilus crataegi Tullgren.
Prociphilus pyri Fitch.
Rhopalosiphum persicae Sulzer.
Rhopalsiphum serotinae Oestlund.

Pyrus "nobilis".

Aphis pyri Kittel.

Pyrus torminalis.

Aphis aucupariae Buckton.
Aphis sorbi Kaltenbach.

Quercus sp.

Aphis annulatus Hartig.
Aphis hirticornis Walker.
Aphis longirostris Fabricius.
Aphis malvae Walker.
Aphis quercifoliae Walsh.
Aphis quercus-monticula Haldeman.
Börneria danesii Grassi & Foa.
Callipterus quercicola Monell.
Chermes atratus Buckton.

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Cinara quercus Mosley.
Lachnus allegheniensis McCook.
Lachnus fuscus Geoffrey.
Lachnus longirostris Boyer.
Myzocallis quercus insignis Ferrari.
Parthenophylloxera ilicis Grassi & Foa.
Pemphigus pedunculi Hartig.
Phyllaphis quercicola Baker.
Phyllaphis quercifoliae Gillette.
Phylloxera bipunctatum Lichtenstein.
Phylloxera lichtensteini Balbiani.
Phylloxera scutifera Signoret.
Phylloxera signoreti Targioni.
Pterocomma populeus longirostris Mordwilko.
Rhynchocles longirostris Altum.
Stomaphis macrorhyncha Cholodkovsky.
Thalaxes quercicola Westwood.
Vacuna glabra Heyden.

Quercus acuta.
Trichosiphum kuwanae Pergande.
Trichosiphum pasaniae Okajama.

Quercus aegilops.
Vacuna dryophila Schrank.

Quercus agrifolia.
Callipterus bellus Walsh.
Phyllaphis querci Fitch.

Quercus alba.
Callipterus bellus Walsh.
Chaitophorus quercicola Monell.
Chaitophorus quercifoliae Fitch.
Phylloxera querceti Pergande.
Phylloxera rileyi Riley.
Stomaphis quercus Linnaeus.
Symbobius albasiphus Davis.

Quercus bicolor.
Myzocallis discolor Monell.
Myzocallis punctatus Monell.
Phylloxera rileyi Riley.

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Quercus cerris.
Callipterus bellus Walsh.
Phylloxera spinulosa Targioni-Tozzetti.
Psylloptera quercina Ferrari.
Pterochlorus cerricola Del Guercio.
Pterochlorus longipes Dufour.
Pterochlorus roboris Linnaeus.
Pterochlorus roboris nigra Del Guercio.

Quercus coccifera.
Phylloxera quercus Boyer.

Quercus coccinea.
Callipterus bellus Walsh.

Quercus cuspidata.
Trichosiphum pasaniae Okajima.
Trichosiphum tenuicorpis Okajima.

Quercus dentata.
Phylloxera querceti Pergande.

Quercus douglasii.
Myzocallis quercus Kaltenbach.

Quercus "fasciata"=Q. Falcata?
Phylloxera punctatus Lichtenstein.

Quercus farnetto.
Phylloxera querceti Pergande.
Phylloxera florentina Targioni-Tozzeti.

Quercus ilex.
Myzocallis quercus Kaltenbach.
Phylloxera coccinea Heyden.
Phylloxera florentina Targioni-Tozzeti.
Phylloxera quercus Boyer.
Pterochlorus croaticus Koch.
Pterochlorus ilicicola Boisduval.
Pterochlorus ilicina Del Guercio.
Pterochlorus iliciphila Del Guercio.
Pterochlorus longipes Dufour.
Pterochlorus roboris Linnaeus.
Vacuna dryophila Schrank.

Quercus imbricaria.
Myzocallis hyalinus Monell.

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Quercus kellogii.
Myzocallis quercus Kaltenbach.

Quercus lamellosa.
Myzocallis hyalinus Monell.

Quercus lobata.
Myzocallis quercus Kaltenbach.

Quercus macrocarpa.
Callipterus bellus Walsh.
Chaitophorus quercicola Monell.
Chaitophorus spinosus Oestlund.
Myzocallis discolor Monell.
Myzocallis punctatus Monell.
Phyllaphis querci Fitch.
Phylloxera querceti Pergande.

Quercus marilandica=Q. nigra.
Longistigma caryae Harris.

Quercus obtusiloba.
Chaitophorus quercicola Monell.
Phylloxera rileyi Riley.

Quercus phellos.
Phyllaphis niger Ashmead.

Quercus prinus.
Chaitophorus quercicola Monell.

Quercus robur.
Abamalekia lazarewi Del Guercio.
Callipterus bellus Walsh.
Myzocallis quercea Kaltenbach.
Myzocallis quercus Kaltenbach.
Phylloxera acanthochermes Lichtenstein.
Phylloxera coccinea Heyden.
Phylloxera corticallis Kaltenbach.
Phylloxera roae Börner.
Phylloxera punctatus Lichtenstein.
Phylloxera quercus Boyer.
Phylloxera spinulosa Targioni-Tozzetti.
Pterochlorus croaticus Koch.
Pterochlorus longipes Dufour.
Pterochlorus minor Del Guercio.

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Pterochlorus roboris Linnaeus.
Schizoneura lusitanica Horvath.
Stomaphis quercus Linnaeus.
Vacuna dryophila Schrank.

Quercus rubra.
Callipterus bellus Walsh.
Myzocallis quercifolii Thomas.
Myzocallis walshii Monell.

Quercus serrata.
Trichosiphum kuwanae Pergande.
Trichosiphum pasaniae Okajima.

Quercus sessilifolia.
Myzocallis quercus Kaltenbach.
Phylloxera florentina Targioni-Tozzeti.
Pterochlorus longipes Dufour.

Quercus stellata.
Myzocallis hyalinus Monell.

Quercus "suber".
Phylloxera quercus Boyer.
Pterochlorus minor Del Guercio.
Tavaresiella suberi Del Guercio.

Quercus undulata.
Phyllaphis querci Fitch.

Quercus virginiana.
Lachnus quercicolens Ashmead.
Phylloxera quercus Boyer.

Radicula armoracia=Cochlearia armoracia.
Aphis armoraciae Cowen.
Rhopalosiphum persicae Sulzer.

Radicula nasturtium-aquaticum=Nasturtium officinalis.
Aphis nasturtii Kaltenbach.
Macrosiphum nasturtii Koch.
Rhopalosiphum persicae Sulzer.

Radicula sinuata=Nasturtium sinuatum.
Pemphigus burrowi Sanborn.

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Radicula sylvestris=Nasturtium sylvestre.
Aphis nasturtii Kaltenbach.
Macrosiphum nasturtii Koch.

Ranunculus sp.
Aphis crataegi Kaltenbach.
Aphis ranunculina Walker.

Ranunculus acris.
Aphis papaveris Fabricius.
Aphis ranunculi Kaltenbach.
Aphis rumicis Linnaeus.
Macrosiphum circumflexa Buckton.
Pemphigus ranunculi Kaltenbach.
Rhopalosiphum persicae Sulzer.
Siphocoryne nymphaeae Linnaeus.
Thecabius affinis Kaltenbach.

Ranunculus aquatilis.
Siphocoryne nymphaeae Linnaeus.

Ranunculus auricomus.
Pemphigus ranunculi Kaltenbach.

Ranunculus bulbosus.
Pemphigus ranunculi Kaltenbach.
Rhopalosiphum persicae Sulzer.
Thecabius affinis Kaltenbach.

Ranunculus californicus.
Pemphigus ranunculi Davidson.
Thecabius populi-conduplifolius Cowen.

Ranunculus flammula.
Pemphigus ranunculi Kaltenbach.
Thecabius affinis Kaltenbach.

Ranunculus fiultans.
Siphocoryne nymphaeae Linnaeus.

Ranunculus muricatus.
Aphis ranunculi Kaltenbach.

Ranunculus repens.
Aphis ranunculi Kaltenbach.
Pemphigus ranunculi Kaltenbach.
Rhopalosiphum persicae Sulzer.
Thecabius affinis Kaltenbach.
Trama radicis Kaltenbach.

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Ranunculus sardous.
Rhopalosiphum persicae Sulzer.

Ranunculus sceleratus.
Siphocoryne nymphaeae Linnaeus.

Ranunculus velutinus.
Myzus ranunculi Del Guercio.
Trama ranunculi Del Guercio.

Raphanus landra.
Aphis brassicae Linnaeus.

Raphanus raphanistrum.
Aphis brassicae Linnaeus.
Aphis erysimi Kaltenbach.
Rhopalosiphum persicae Sulzer.

Raphanus sativus.
Aphis brassicae Linnaeus.
Aphis pseudobrassicae Davis.
Aphis raphani Schrank.
Rhopalosiphum persicae Sulzer.

Rapistrum rugosum.
Rhopalosiphum persicae Sulzer.

Reseda sp.
Aphis rumicis Linnaeus.

Reseda odorata.
Aphis introducta Walker.

Rhamnus alaternus.
Aphis rhamni Kaltenbach.
Toxoptera alaterni Del Guercio.
Toxoptera variegata Del Guercio.

Rhamnus alpina.
Aphis rhamni Kaltenbach.
Myzus rhamni Boyer.

Rhamnus californica.
Macrosiphum rhamni Clarke.

Rhamnus cathartica.
Myzus rhamni Boyer.

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Rhamnus frangula.
Aphis cathartica Del Guercio.
Aphis frangulae Koch.
Aphis evonymi Fabricius.
Aphis rhamni Kaltenbach.
Myzus rhamni Boyer.

Rhamnus lanceolata.
Aphis frangulae Koch.
Aphis rhamni Kaltenbach.

Rhamnus purshiana.
Myzus rhamni Boyer.

Rheum rhaponticum.
Aphis rhei Koch.
Aphis rumicis Linnaeus.

Rhinanthus major.
Aphis myosotidis Koch.

Rhinanthus minor.
Amphorophora rhinanthi Schouteden.

Rhodolypus kerriaides.
Aphis rumicis Linnaeus.

Rhus sp.
Schlectendalia chinensis Bell.

Rhus glabra.
Liosomaphis rhois Monell.
Melaphis rhois Fitch.

Rhus semialata.
Schlectendalia sinense Walker.

Rhus trilobata.
Liosomaphis rhois Monell.

Rhus typhina.
Melaphis rhois Fitch.

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Ribes spp.
Aphis sanborni Patch.
Aphis varians Patch.
Myzus dispar Patch.
Myzus ribis bucktonii Del Guercio.
Myzus whitei Theobald.
Rhopalosiphum brittenii Theobald.
Schizoneura grossulariae Taschenberg.

Ribes alpinum.
Myzus ribis Linnaeus.

Ribes aureum.
Aphis cornifoliae Fitch.
Aphis rumicis Linnaeus.
Macrosiphum cynosbati Oestlund.
Myzus ribis Linnaeus.

Ribes cynosbati.
Macrosiphum cynosbati Oestlund.

Ribes grossularia.
Aphis grossulariae Kaltenbach.
Aphis urticaria Kaltenbach.
Macrosiphum ribicola Kaltenbach.
Myzus ribis Linnaeus.
Rhopalosiphum lactucae Kaltenbach.
Schizoneura ulmi Linnaeus.

Ribes lepanthum.
Myzus neomexicanus Cockerell.

Ribes nigrum.
Aphis grossulariae Kaltenbach.
Myzus ribis Linnaeus.
Rhopalosiphum lactucae Kaltenbach.
Rhopalosiphum ribesina Van Der Goot.
Schizoneura fodiens Buckton.
Schizoneura ulmi Linnaeus.

Ribes rotundifolium.
Aphis houtoneniss Troop.
Myzus ribis Linnaeus.

Ribes sanguineum.
Aphis grossulariae Kaltenbach.
Aphis houtonensis Troop.

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Ribes viscosissimum.
Myzus ribis Linnaeus.

Ribes vulgare=R. rubrum.
Aphis grossulariae Kaltenbach.
Aphis ribis Sanborn.
Myzus ribis Linnaeus.
Myzus ribis trifasciata Del Guercio.
Rhopalosiphum lactucae Kaltenbach.

Richardia africana.
Macrosiphum callae Heinrich.
Macrosiphum circumflexa.
Rhopalosiphum persicae Sulzer.
Siphocoryne nymphaeae Linnaeus.

Ricinus communis.
Rhopalosiphum persicae Sulzer.

Robinia pseudo-acacia.
Aphis laburni Kaltenbach.
Aphis robiniae Macchiati.
Aphis rumicis Linnaeus.
Callipterus robiniae Gillette.
Macrosiphum ulmariae Schrank.
Rhopalosiphum persicae Sulzer.

Robinia viscosa.
Aphis medicaginis Koch.

Rosa sp.
Aphis diplepha Refinesque.
Aphis rhodryas Rafinesque.
Hyalopterus flavus Schouteden.
Lachnus maculatus Lichtenstein.
Lachnus rosarum Van Der Goot.
Macrosiphum pallida Oestlund.
Macrosiphum rosaefolium Theobald.
Macrosiphum rosaeollae Theobald.
Macrosiphum rosarum Koch.
Macrosiphum solanifolii Ashmead.
Macrosiphum ulmariae Schrank.
Rhopalosiphum nervatum Gillette.

Rosa californica.
Myzus rosarum Walker.

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Rosa canina.

Hyalopterus trirhoda Walker.
Lashnus rosae Cholodkovsky.
Macrosiphum dirhoda Walker.
Macrosiphum rosae Linnaeus.
Macrosiphum rosae glauca Buckton.
Myzus rosarum Kaltenbach.
Myzus tetrarhoda Walker.

Rosa centifolia.

Hyalopterus dilineatus Buckton.
Macrosiphum dirhoda Walker.
Macrosiphum rosae Linnaeus.
Macrosiphum rosae glauca Buckton.
Myzus rosarum Kaltenbach.
Myzus roseus Macchiati.
Myzus tetrarhoda Walker.

Rosa cinnamomea.

Hyalopterus aquilegiae-flavus Kittel.

Rosa eglanteria.

Macrosiphum dirhoda Walker.
Macrosiphum rosae Linnaeus.

Rosa gallica.

Hyalopterus trirhoda Walker.
Myzus rosarum Kaltenbach.
Myzus roseus Macchiati.
Myzus tetrarhoda Walker.

Rosa lutea.

Macrosiphum rosae Linnaeus.

Rosa rubiginosa.

Aphis rosa?suaveolens Rafinesque.
Macrosiphum rosae Linnaeus.
Macrosiphum rosaecola Passerini.
Myzus rosarum Kaltenbach.

Rosa rugosa.

Macrosiphum dirhoda Walker.
Myzus rosarum Kaltenbach.

Rosa spinosissima.

Macrosiphum rosae Linnaeus.
Myzus rosarum Kaltenbach.

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Rubus sp.
Aphis mordwilkiana Dobrowljansky.
Aphis rubiphila Patch.

Rubus caesius.
Aphis urticae Fabricius.
Macrosiphum rubi Kaltenbach.

Rubus corylifolius.
Macrosiphum rubi Kaltenbach.

Rubus "discolor".
Macrosiphum rubi Kaltenbach.

Rubus fructicosus.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.
Macrosiphum cyparissiae Koch.
Macrosiphum rubi Kaltenbach.
Macrosiphum rubiellum Theobald.

Rubus idaeus.
Aphis idaei Van Der Goot.
Aphis rubicola Oestlund.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.
Macrosiphum chelidonii Kaltenbach.
Macrosiphum funesta Macchiati.
Macrosiphum poae Macchiati.
Macrosiphum rubi Kaltenbach.
Macrosiphum rubiellum Theobald.
Nactarosiphon rubicola Oestlund.

Rubus nutkanus.
Nectarosiphon rubicola Oestlund.

Rubus occidentalis.
Cerosipha rubicolii Thomas.
Macrosiphum rubi Kaltenbach.
Pemphigus rubi Thomas.

Rubus ulmifolius.
Hyalopterus trirhoda Walker.

Rubus villosus.
Cerosipha rubifolii Thomas.
Macrosiphum ambrosiae Thomas.
Macrosiphum rubi Kaltenbach.

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Rudbeckia sp.
Macrosiphum ambrosiae Thomas.
Rhopalosiphum persicae Sulzer.

Rudbeckia amplexicaulis.
Macrosiphum rudbeckiae Fitch.
Macrosiphum rudbeckiarum Cockerell.

Rudbeckia hirta.
Macrosiphum martini Cockerell.

Rudbeckia laciniata.
Macrosiphum circumflexa Buckton.
Macrosiphum rudbeckiae Fitch.

Rumex sp.
Pemphigus globosus Walker.

Rumex acetosa.
Aphis acetosae Linnaeus.
Aphis acetosae Buckton.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Rumex acetosella.
Aphis rumicis Linnaeus.

Rumex acutus.
Aphis rumicis Linnaeus.

Rumex altissimus.
Aphis artiplicis Linnaeus.
Aphis carbocolor Gillette.
Aphis maidis Fitch.
Aphis maidi-radicis Forbes.
Aphis malvae Walker.
Aphis ochropus Koch.
Aphis relata Walker.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Rumex amplexicaulis.
Aphis rumicis Linnaeus.

Rumex conglomeratus.
Aphis acetosae Buckton.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

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Rumex crispus.
Aphis atriplicis Linnaeus.
Aphis gossypii Glover.
Aphis maidi-radicis Forbes.
Aphis radicola Mordwilko.
Aphis rumicis Linnaeus.
Macrosiphum tabaci Pergande.
Macrosiphum venaefuscae Davis.
Pemphigus betae Doane.
Rhopalosiphum persicae Sulzer.

Rumex hydrolapthum.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Rumex hymenosepalus.
Pemphigus betae Doane.

Rumex intermedius.
Aphis rumicis Linnaeus.

Rumex obtusifolius.
Aphis rumicis Linnaeus.
Macrosiphum circumflexa Buckton.

Rumex occidentalis.
Pemphigus betae Doane.
Pemphigus brevicornis Hart.

Rumex pulcher.
Aphis rumicis Linnaeus.

Rumex venosus.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Ruta graveolens.
Macrosiphum jaceae Linnaeus.

Saccharum officinarum.
Aphis adusta Zehntner.
Aphis bituberculata Wilson.
Aphis gossypii Glover.
Aphis maidis Fitch.
Aphis sacchari Zehntner.
Oregma lanigera Zehntner.
Tetraneura lucifuga Zehntner.

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Sagittaria sagittifolia.

Siphα glyceriae Kaltenbach.
Siphocoryne numphaeae Linnaeus.

Salix sp.

Aphis farinosa DeGeer.
Aphis furcula Zetterstedt.
Aphis fuscula Zetterstedt.
Aphis gracilis Walker.
Aphis nigripes Theobald.
Aphis pilosa Haldeman.
Aphis salicariae Koch.
Aphis salicina Zetterstedt.
Aphis salicis DeGeer.
Aphis salicis Sulzer.
Chaitophorus salicis Willlams.
Lachnus dentatus LeBaron.
Lachnus salicellis Fitch.
Lachnus saliana Gmelin.
Macrosiphum californica Clarke.
Melanoxantherium antennatum Patch.
Myzus ascelepiadis Passerini.
Pemphigus salicis Lichtenstein.
Phylloxera salicis Lichtenstein.
Pterocomma bicolor Oestlund.
Pterocomma populeus longirostris Mordwilko.
Pterocomma rufulus Davidson.
Pterocomma salicti Harris.
Rhopalosiphum persicae Sulzer.
Siphoorcyne aegopodii Scopoli.
Stomaphis bobretzkyi Mordwilko.

Salix alba.

Aphis amenticola Kaltenbach.
Aphis longirostris Fabricius.
Aphis rumicis Linnaeus.
Chaitophorus salicti Schrank.
Chaitophorus viminalis Monell.
Chaitophorus vitellinae Schrank.
Lachnus longirostris Boyer.
Lachnus punctatus Burmeister.
Lachnus viminalis Boyer.
Pterocomma populea Kaltenbach.
Pterocomma salicis Linnaeus.
Pterocomma smithiae Monell.
Pterocomma steinheili Mordwilko?
Siphocoryne capreae Fabricius.

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Salix amygdaloides=S. nigra.
Aphis rumicis Linnaeus.
Aphis salicicola Thomas.
Arctaphis populi Linnaeus.
Chaitophorus leucomelas Koch.
Siphocoryne capreae Fabricius.

Salix aurita.
Aphis saliceti Kaltenbach.
Siphocoryne pastinaceae Linnaeus.

Salix babylonica.
Aphis rumicis Linnaeus.
Aphis saliceti Kaltenbach.
Arctaphis populi Linnaeus.
Chaitophorus viminalis Monell.
Chaitophorus vitellinae Schrank.
Siphocoryne capreae Fabricius.
Siphocoryne pastinaceae Linnaeus.
Siphocoryne salicis Monell.

Salix caprea.
Aphis alterna Walker.
Aphis rumicis Linnaeus.
Aphis saliceti Kaltenbach.
Aphis secunda Walker.
Aphis truncata Hausmann.
Chaitophorus capreae Koch.
Chaitophorus salicivora Walker.
Chaitophorus salicti Schrank.
Lachnus viminalis Boyer.
Pterocomma populea Kaltenbach.
Pterocomma salicis Linnaeus.
Siphocoryne capreae Fabricius.

Salix cinerea.
Aphis saliceti Kaltenbach.
Chaitophorus salicivora Walker.
Chaitophorus salicti Schrank.
Lachnus viminalis Boyer.
Pterocomma flocculosus Weed.
Pterocomma pilosa Buckton.
Pterocomma salicis Linnaeus.

Salix cordata.
Chaitophorus cordatae Williams.
Chaitophorus viminalis Monell.

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Salix daphnoides.
Lachnus viminalis Boyer.
Pterocomma pilosa Buckton.

Salix discolor.
Aphis salicicola Thomas.
Phylloxera salicola Pergande.

Salix fragilis.
Aphis saliceti Kaltenbach.
Chaitophorus capreae Koch.
Chaitophorus salicivora Walker.
Chaitophorus vitellinae Schrank.
Lachnus viminalis Boyer.
Pterocomma salicis Linnaeus.

Salix laevigata.
Chaitophorus salicicola Essig.
Fullawaya saliciradicis Essig.
Macrosiphum laevigatae Essig.
Micrella monelli Essig.
Symdobius salicicorticis Essig.

Salix lapponum.
Chaitophorus salicivora Walker.

Salix lasiolepis.
Micrella monelli Essig.
Phylloxera salicola Pergande.

Salix longifolia.
Chaitophorus nigrae Oestlund.
Pterocomma salicis Linnaeus.
Siphocoryne salicis Monell.
Thomasia crucis Essig.
Symbobius macrostachyae Essig.

Salix lucida.
Chaitophorus viminalis Monell.
Pterocomma salicis Linnaeus.
Siphocoryne capreae Fabricius.
Siphocoryne salicis Monell.

Salix nigra.
Chaitophorus nigrae Oestlund.
Siphocoryne salicis Monell.

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Salix nigricans.
Chaitophorus salicti Schrank.
Pterocomma populea Kaltenbach.

Salix pentandra.
Pterocomma salicis Linnaeus.

Salix purpurea.
Aphis saliceti Kaltenbach.
Chaitophorus salicivora Walker.
Lachnus viminalis Boyer.

Salix repens.
Chaitophorus hypogeus Schouteden.

Salix smithiana.
Pterocomma smithiae Monell.

Salix speciosa.
Aphis spectabilis Ferrari.

Salix triandra.
Chaitophorus vitellinae Schrank.
Pterocomma salicis Linnaeus.

Salix viminalis.
Aphis longirostris Fabricius.
Aphis saliceti Kaltenbach.
Chaitophorus viminalis Monell.
Lachnus viminalis Boyer.
Pterocomma pilosa Buckton.
Pterocomma populea Kaltenbach.
Pterocomma salicis Linnaeus.

Salsola kali.
Aphis rufula Walker.
Hyalopterus arundinis Fabricius.
Rhopalosiphum persicae Sulzer.

Salvia aethiopis.
Aphis salviae Walker.

Salvia ceratophylloides.
Aphis salviae Walker.
Rhopalosiphum elegans Ferrari.

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Salvia pratensis.
Aphis salviae Walker.

Salvia rectiflora.
Rhopalosiphum elegans Ferrari.

Salvia splendens.
Cerosipha passeriniana Del Guercio.

Salvinia natans.
Siphocoryne nymphaeae Linnaeus.

Sambucus sp.
Aphis davisiana Del Guercio.
Aphis amelophila Del Guercio.

Sambucus canadensis.
Aphis sambuci Linnaeus.
Aphis sambucifoliae Fitch.
Macrosiphum circumflexa Buckton.

Sambucus ebulus.
Aphis sambuci Linnaeus.

Sambucus glauca.
Macrosiphum stanleyi Wilson.

Sambucus nigra.
Aphis advena Walker.
Aphis exul Walker.
Aphis impacta Walker.
Aphis picta Walker.
Aphis sambucaria Passerini.
Aphis sambuci Linnaeus.
Aphis sambucifoliae Fitch.

Sanguisorba sp.=Poterium sp.
Aphis sanguisorbae Schrank.

Sanicula canadensis.
Aphis caniculae Williams.

Satureja nepeta=Calamintha nepeta.
Aphis nepetae Kaltenbach.
Aphis origani Passerini.

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Satureja vulgaris=Calamintha vulgaris.
Aphis clinipodii Passerini.
Aphis nepetae Kaltenbach.
Aphis origani Passerini.
Macrosiphum solani Kaltenbach.
Phorodon calaminthae Macchiati.

Saururus cernus.
Siphocoryne nymphaeae Linnaeus.

Scabiosa arvensis.
Aphis confusa Walker.
Aphis conspersa Walker.
Aphis scabiosae Scopoli.
Macrosiphum jaceae Linnaeus.
Macrosiphum rosae Linnaeus.
Macrosiphum scabiosae Schrank.
Macrosiphum solidaginis Fabricius.

Scabiosa columbaria.
Aphis chloris Koch.
Aphis scabiosae Scopoli.
Macrosiphum rosae Linnaeus.
Macrosiphum scabiosae Schrank.

Scabiosa succisa.
Aphis scabiosae Scopoli.
Macrosiphum cyparissiae Koch.
Macrosiphum rosae Linnaeus.
Macrosiphum scabiosae Schrank.

Scabiosa sylvatica.
Macrosiphum scabiosae Schrank.

Schizanthus sp.
Macrosiphum circumflexa Buckton.

Scirpus sp.
Aphis scirpi Kittel.
Saltusaphis scirpus Theobald.

Scirpus cernuus.
Toxoptera scirpi Passerini.

Scirpus caespitosus.
Hyalopterus arundinis Fabricius.

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Scirpus lacustris.
Hyalopterus arundinis Fabricius.
Toxoptera scirpi Passerini.

Scolymnus sp.
Myzus bragii Gillette.

Scolymnus hispanicus.
Aphis cardui Linnaeus.

Scorzonera hirsuta.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.

Scrophularia galericulata. (?)
Aphis chloris Koch.

Scrophularia marylandica=S. nodosa.
Phorodon scrophulariae Thomas.

Scrophularia scorodonia.
Macrosiphum scrophulariae Buckton.

"Sea Wormwood".
Aphis reducta Walker.

Secale cereale.
Aphis avenae Fabricius.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirohoda Walker.
Macrosiphum granarium Kirby.
Toxoptera graminum Rondani.

Sedum acre.
Aphis sedi Kaltenbach.

Sedum album.
Aphis sedi Kaltenbach.

Sedum maximum.
Aphis sedi Kaltenbach.

Sedum "reflexum".
Aphis sedi Kaltenbach.

Sedum telephium.
Aphis sedi Kaltenbach.

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Semele androgyne.
Rhopalosiphum persicae Sulzer.

Senecio canus.
Aphis senecionis Williams.

Senecio cineraria.
Macrosiphum circumflexa Buckton.

Senecio crassifolius.
Aphis myosotidis Koch.
Rhopalosiphum persicae Sulzer.

Senecio erucifolius.
Aphis cardui Linnaeus.

Senecio jacobaea.
Aphis cardui Linnaeus.
Aphis jacobaeae Schrank.
Aphis jacobaeae Walker.
Aphis jacobae-balsamita Rafinesque.
Macrosiphum subterranea Koch.
Rhopalosiphum persicae Sulzer.

Senecio longifolius.
Aphis myosotidis Koch.

Senecio lugens.
Aphis lugentis Williams.

Senecio mikanioides.
Aphis rumicis Linnaeus.

Senecio sarracenicus.
Aphis jacobaeae Schrank.

Senecio tomentosus.
Aphis maidi-radicis Forbes.

Senecio viscosus.
Macrosiphum jacae Linnaeus.

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Senecio vulgaris.
Aphis bakeri Cowen.
Aphis apposita Walker.
Aphis balsamitae Müller.
Aphis cardui Linnaeus.
Aphis diminuta Walker.
Aphis helichrysi Kaltenbach.
Aphis jacobaeae Schrank.
Aphis lata Walker.
Aphis lateralis Walker.
Aphis myosotidis Koch.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Macrosiphum jaceae Linnaeus.
Rhopalosiphum persicae Sulzer.

Seseli sp.
Aphis seselii Lichtenstein.

Setaria.
Tychea setulosa Passerini.
Tychea trivialis Passerini.

Setaria glauca.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Aphis maidis Fitch.
Aphis maidi-radicis Forbes.
Aphis setariae Thomas.
Endeis bella Koch.
Macrosiphum granarium Kirby.
Schizoneura panicola Thomas.
Schizoneura venusta Passerini.
Sipha flavus Forbes.
Toxoptera graminum Rondani.
Tychea eragrostidis Passerini.
Tychea panici Thomas.
Tychea setariae Passerini.

Setaria italica.
Anoecia corni Fabricius.
Aphis corni Fabricius.
Aphis avenae Fabricius.
Aphis maidi-radicis Forbes.
Macrosiphum granarium Kirby.
Schizoneura verusta Passerini.
Toxoptera graminum Rondani.

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Setaria verticillata.
Aphis papaveris Fabricius.
Endeis bella Koch.
Schizoneura venusta Passerini.
Tychea setariae Passerini.

Setaria viridis.
Anoecia corni Fabricius.
Aphis maidis Fitch.
Aphis maidi-radicis Forbes.
Aphis papaveris Fabricius.
Aphis setariae Thomas.
Endeis bella Koch.
Macrosiphum cerealis Kaltenbach.
Schizoneura panicola Thomas.
Schizoneura venusta Passerini.
Tychea eragrostidis Passerini.
Tychea setariae Passerini.

Shepherdia sp.
Rhopalosiphum hippophaës.

Shepherdia argentea.
Capitophorus shepherdiae Gillette & Bragg.
Myzus braggii Gillette.
Myzus elaeagin Del Guercio.

Silene cucubalus.
Aphis cucubali Passerini.
Aphis silenea Ferrari.
Hyalopterus melanocephalus Buckton.
Myzus lychnidis Linnaeus.

Silene italica.
Myzus lychnidis Linnaeus.

Silene latifolia.
Aphis cucubali Passerini.
Aphis silenea Ferrari.
Hyalopterus melanocephalus Buckton.
Macrosiphum sileneum Theobald.
Myzus lychnidis Linnaeus.
Pemphigus inflatae Del Guercio.

Silene maritima.
Aphis cadiva Walker.

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Silphium integrifolium.
Macrosiphum rudbeckiae Fitch.

Silphium perfoliatum.
Macrosiphum rudbeckiae Fitch.

Silybum marianum.
Aphis silybi Passerini.
Trama troglodytes Heyden.

Sisymbrium alliaria.
Aphis erysimi Kaltenbach.
Macrosiphum alliariae Koch.
Macrosiphum alliariae Linnaeus (Koch).
Macrosiphum kaltenbachi Schouteden.
Macrosiphum sisymbrii Buckton.
Macrosiphum sonchi Linnaeus.
Rhopalosiphum persicae Sulzer.

Sisymbrium arnottianum.
Rhopalosiphon sisymbrii Del Guercio.

Sisymbrium austriacum.
Rhopalosiphum persicae Sulzer.

Sisymbrium officinale.
Aphis erysimi Kaltenbach.
Aphis nasturtii Kaltenbach.
Macrosiphum alliariae Koch.
Macrosiphum alliariae Linnaeus (Koch).
Macorsiphum sisymbrii Buckton.
Macrosiphum sonchi Linnaeus.
Siphyocoryne pastinaceae Linnaeus.

Sium latifolium.
Aphis rumicis Linnaeus.

Smilax sp.
Mordwilkoja vagabunda Walsh.

Smilax herbacea.
Lachnus smilacis Williams.

Smilax rotundifolia.
Pemphigus attenuatus Osborn-Sirrine.

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Sobralia sp.
Cerataphis lataniae Lichtenstein.

Solanum sp.
Aphis solanella Theobald.
Megoura solani Thomas.

Solanum dulcamara.
Aphis rumicis Linnaeus.
Aphis solani Kittel.
Rhopalosiphum dianthi Schrank.
Rhopalosiphum persicae Sulzer.

Solanum elaeagnifolium.
Aphis solanina Passerini.

Solanum giganteum.
Aphis scabiosae Scopoli.

Solanum guianense.
Aphis silybi Passerini.

Solanum jasminoides.
Aphis rumicis Linnaeus.
Macrosiphum solani Kaltenbach.
Macrosiphum solanifolii Ashmead.

Solanum melongena.
Macrosiphum solanifolii Ashmead.
Macrosiphum tabaci Pergande.
Rhopalosiphum persicae Sulzer.

Solanum nigrum.
Aphis nerii Kaltenbach.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Aphis silybi Passerini.
Aphis soalni Kittel.
Macrosiphum solani Kaltenbach.
Rhopalosiphum persicae Sulzer.
Trifidaphis radicicola Essig.

Solanum sodomeum.
Aphis solanina Passerini.

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Solanum tuberosum.
Aphis gossypii Glover.
Aphis papaveris Linnaeus.
Aphis rumicis Linnaeus.
Macrosiphum lactucae Linnaeus.
Macrosiphum solani Kaltenbach.
Macrosiphum solanifolii Ashmead.
Macrosiphum sonchi Linnaeus.
Rhopalosiphum dianthi Schrank.
Rhopalosiphum jerseicae Sulzer.

Solanum villosum.
Aphis solani Kittel.

Solidago sp.
Pemphigus betae Doane.

Solidago canadensis.
Aphis gibbosa Rafinesque.
Aphis middletonii Thomas.
Aphis solidaginifoliae Williams.
Macrosiphum solidaginis Fabricius.

Solidago missouriensis.
Macrosiphum circumflexa Buckton.
Macrosiphum luteola Williams.

Solidago nemoralis.
Aphis xanthelis Rafinesque.

Solidago odora.
Aphis gibbosa Rafinesque.

Solidago rigida.
Macrosiphum rudbeckiae Fitch.
Rphopalosiphum serotinae Oestlund.

Solidago serotina.
Aphis middletonii Thomas.
Aphis rumicis Linnaeus.
Macrosiphum rudbeckiae Fitch.
Macrosiphum solidaginis Fabricius.
Rhopalosiphum serotinae Oestlund.

Solidago virgaurea.
Aphis rumicis Linnaeus.
Macrosiphum solidaginis Fabricius.

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Sonchus arvensis.
Macrosiphum sonchi Linnaeus.
Myzus ribis Linnaeus.
Rhizobius sonchi Passerini.
Rhopalosiphum lactucae Kaltenbach.
Trama troglodytes Heyden.

Sonchus asperis.
Macrosiphum sonchi Linnaeus.
Pemphigus bursarius Linnaeus.
Rhizobius sonchi Passerini.
Rhopalosiphum lactucae Kaltenbach.
Rhopalosiphum sonchi Oestlund.
Trama horvathi Del Guercio.
Trama troglodytes Heyden.

Sonchus oleraceus.
Aphis terricola Rondani.
Forda formicaria Heyden.
Macrosiphum alliariae Linnaeus (Koch).
Macrosiphum jaceae Linnaeus.
Macrosiphum lactucae Linnaeus.
Macrosiphum rudbeckiae Fitch.
Macrosiphum solanifolii Ashmead.
Macrosiphum sonchella Monell.
Macrosiphum sonchi Linnaeus.
Macrosiphum trifolii Pergande.
Myzus ribis Linnaeus.
Pemphigus bursarius Linnaeus.
Pemphigus lactucarius Passerini.
Rhizobius sonchi Passerini.
Rhopalosiphum lactucae Kaltenbach.
Rhopalosiphum persicae Sulzer.
Trama horvathi Del Guercio.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

Sorghum sp.
Aphis sorghella Schouteden.

Sorghum dora.
Aphis maidi-radicis Forbes.
Aphis maidis Fitch.
Sipha flavus Fitch.

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Sorghum halepense.
Aphis avenae Fabricius.
Aphis maidis Fitch.
Aphis maidi-radicis Forbes.
Sipha flavus Forbes.
Sipha maydis Passerini.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.

Sorghum saccharatum=S. vulgare.
Aphis avenae Fabricius.
Aphis maidi-radicis Forbes.
Aphis maidis Fitch.
Macrosiphum caianense Del Guercio.
Pemphigus fuscifrons saccahrata Del Guercio.
Pemphigus radicum Boyer.
Sipha flavus Forbes.
Sipha maydis Passerini.
Tetraneura ulmi Linnaeus.

Sorghum vulgare.
Anoecia corni Fabricius.
Aphis africana Theobald.
Aphis avenae Fabricius.
Aphis sorghi Theobald.
Pemphigus radicum Boyer.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.

Sparganium ramosum.
Siphocoryne nymphaeae Linnaeus.

Spartina cynosuroides=S. schreberi.
Anoecia corni Linnaeus.

Spartium junceum.
Aphis medicaginis Koch.
Aphis rumicis Linnaeus.
Macrosiphum ulmariae Schrank.
Schizoneura sparthanti Boisduval.

Spartium scoparum.
Macrosiphum ulmariae Schrank.

Specularia speculum.
Macrosiphum campanulae Kaltenbach.
Macrosiphum sonchi Linnaeus.

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Spergula arvensis.
Rhopalosiphum persicae Sulzer.

Sphaeralcea "pendleri".
Aphis medicaginis Koch.

Spinacia oleracea.
Aphis brassicae Linnaeus.
Aphis gossypii Glover.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Spiraea sp.
Acyrthosiphon ignotum Mordwilko.
Acyrthosiphon soldattovi Mordwilko.

Spiraea chamardryfolia.
Aphis rumicis Linnaeus.

Spiraea prunifolia.
Aphis spiraeae Schouteden.
Aphis spireaella Schouteden.

Spiraea salicifolia.
Aphis spireaella Schouteden.
Aphis spiraeae Oestlund.
Aphis spiraephila Patch.

Spiraea ulmaria.
Aphis spiraeae Schouteden.
Aphis spireaella Schouteden.
Macrosiphum cholodkovskyi Mordwilko.
Macrosiphum pisi Kaltenbach.
Macrosiphum portiscinskyi Mordwilko.
Macrosiphum scabiosae Schrank.
Macrosiphum ulmariae Schrank.

Spiraea vanhouttei.
Aphis spiraeae Schouteden.
Aphis spireaella Schouteden.
Macrosiphum spiraecola Patch.

"Spiraxis".
Macrosiphum circumflexa Buckton.

Spirodela polyrrhiza=Lemna polyrrhiza.
Siphocoryne nymphaeae Linnaeus.

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Sporobolus neglectus.
Toxoptera graminum Rondani.

"Spruce fir".
Dryobius cistatus Buckton.

Stachys annua.
Rhizobius sonchi Passerini.

Stachys arvensis.
Phorodon galeopsidis Kaltenbach.

Stachys germanica.
Phorodon galeopsidis Kaltenbach.

Stachys recta.
Aphis chloris Koch.
Aphis eupatorii Passerini.
Aphis symphiti Schrank.
Aphis urticae Fabricius.
Phorodon galeopsidis Kaltenbach.

Stachys sylvatica.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.
Phorodon galeopsidis Kaltenbach.

Staphylea pinnata.
Rhopalosiphum staphyleae Koch.

Steironema ciliatum.
Aphis rumicis Linnaeus.

Steironema heterophyllum.
Macrosiphum circumflexa Buckton.

Stellaria aquatica.
Aphis nasturtii Kaltenbach.
Macrosiphum nasturtii Koch.

Stellaria graminea.
Brachycolus stellariae Hardy.
Macrosiphum cerastii Kaltenbach.
Macrosiphum stellariae Theobald.

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Stellaria holostea.
Brachycolus stellariae Hardy.
Macrosiphum cerastii Kaltenbach.
Macrosiphum pisi Kaltenbach.

Stellaria media.
Aphis gossypii Glover.
Brachycolus stellariae Hardy.
Rhopalosiphum persicae Sulzer.

Stipa comata.
Brachycolus tritici Gillette.

Stipa setigera.
Toxoptera graminum Rondani.

Stipa viridula.
Toxoptera graminum Rondani.

Straussia sp.
Toxoptera aurantii Boyer.

Styrax benzoin.
Astegopteryx styracophila Karsch.

Styrax japonicum.
Astegopteryx nekoashii Sasaki.

Symphitum officinale.
Aphis consolidae Passerini.
Aphis symphiti Schrank.

Symphoricarpos occidentalis.
Aphis albipes Oestlund.
Aphis pulverulens Gillette.
Aphis symphoricarpi Thomas.

Symphoricarpos orbiculatus.
Aphis albipes Oestlund.
Aphis symphoricarpi Thomas.

Symphoricarpos racemosa.
Aphis albipes Oestlund.
Aphis symphoricarpi Thomas.

Synosma suaveolens.
Macrosiphum rudbeckiae Fitch.

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Syntherisana sanguinale=Panicum sanguinale=Digitaria sanguinale.
Aphis avenae Fabricius.
Macrosiphum granarium Kirby.

Syringa vulgaris.
Prociphilus fraxini Linnaeus.
Prociphilus venafuscus Patch.
Rhopalosiphum persicae Sulzer.

"Tamarantia sp."
Aphis sorbi Kaltenbach.

"Tamarix".
Aphis rumicis Linnaeus.
Aphis tamaricis Lichtenstein.

Tanacetum sp.
Aphis persequens Walker.

Tanacetum vulgare.
Aphis helichrysi Kaltenbach.
Aphis tanacetina Walker.
Macrosiphum artemisiae Boyer.
Macrosiphum lilacina Ferrari.
Macrosiphum tanacetaria Kaltenbach.
Macrosiphum tanaceticola Kaltenbach.
Macrosiphum ulmariae Schrank.
Myzus tanaceti Linnaeus.

Taraxacum sp.
Aphis leontodoniella Theobald.
Trama rara Mordwilko.

Taraxacum officinale.
Aphis dauci Fabricius.
Aphis gossypii Glover.
Aphis intybi Koch.
Aphis plantaginis Schrank.
Macrosiphum picridis Fabricius.
Macrosiphum taraxaci Kaltenbach.
Macrosiphum trifolii Pergande.
Rhopalosiphum persicae Sulzer.
Trama radicis Kaltenbach.
Trama troglodytes Heyden.

Taxus baccata.
Chermes taxi Buckton.

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Tecoma radicans.
Aphis nerii Kaltenbach.
Sipha bignoniae Macchiati.

Teucrium sp.
Aphis teucrii Lichtenstein.
Phorodon calaminthae Macchiati.

Teucrium chamaedrys.
Phorodon chamaedrys Passerini.

Teucrium scorodonia.
Aphis scorodoniae Del Guercio.

Thalictrum aquilegiifolium.
Aphis thalictri Koch.

Thalictrum minus.
Aphis brassicae Linnaeus.
Aphis thalictri Koch.
Rhopalosiphum persicae Sulzer.

Thalictrum revolutum.
Macrosiphum purpurascens Oestlund.
Myzus thalactri Williams.

Thaspium aureum.
Aphis thaspii Oestlund.

Thea (Camellia) japonica.
Toxoptera aurantii Boyer.

Theobroma cacoa.
Myzus theacola Buckton.
Toxoptera theobromae Schouteden.

Thlaspi sp.
Aphis rumicis Linnaeus.
Aphis thlaspeos Schrank.

Thuja occidentalis.
Aphis longirostris Fabricius.
Lachniella tujafilina Del Guercio.
Lachniella tujae Del Guercio.
Lachnus juniperi signata Del Guercio.
Lachnus juniperinus Mordwilko.

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Thuja orientalis.
Lachniella thujafolia Theobald.

Thymus serpyllum.
Aphis rumicis Linnaeus.
Aphis serpylli Koch.

Tilia americana.
Drepanosiphum tiliae Koch.
Euceraphis betulaecolens Fitch.
Eucallipterus tiliae Linnaeus.
Longistigma caryae Harris.
Macrosiphum tiliae Monell.

Tilia cordata.
Eucallipterus tiliae Linnaeus.
Longistigma caryae Harris.
Schizoneura reaumuri Kaltenbach.

Tilia grandifolia.
Drepanosiphum tiliae Koch.
Schizoneura reaumuri Kaltenbach.

Tilia platyphyllos.
Drepanosiphum tiliae Koch.
Eucallipterus tiliae Linnaeus.
Schizoneura reaumuri Kaltenbach.

Tilia rubra.
Aphis adducta Walker.
Eucallipterus tiliae Linnaeus.

Tilia tomentosa.
Schizoneura reaumuri Kaltenbach.

Tilia vulgaris.
Eucallipterus tiliae Linnaeus.
Schizoneura reaumuri Kaltenbach.

Tordylium apulum.
Aphis carotae Koch.

Townsendia sericea.
Rhopalosiphum persicae Sulzer.

Tragopogon dubius.
Aphis tragopogonis Kaltenbach.

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Tragopogon porrifolius.
Aphis tragopogonis Kaltenbach.

Tragopogon pratensis.
Aphis rumicis Linnaeus.
Aphis tragopogonis Kaltenbach.
Macrosiphum ulmariae Schrank.

Trapa sp.
Siphocoryne nymphaeae Linnaeus.

Tridens flavus=Poa flavus.
Hyalopterus dactylidis Hayhurst.

Trifolium sp.
Acyrthosiphon pisi turanicum Mordwilko.
Aphis rumicis Linnaeus.
Geoica squamosa Hart.

Trifolium alexandrinum.
Myzocallis ononidis Kaltenbach.

Trifolium filaforme.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Trifolium hybridum.
Macrosiphum pisi Kaltenbach.

Trifolium incarnatum.
Macrosiphum pisi Kaltenbach.

Trifolium ochroleucum.
Aphis medicaginis Koch.

Trifolium pratense.
Aphis bakeri Cowen.
Aphis gossypii Glover.
Aphis helichrysi Kaltenbach.
Aphis trifolii Oestlund.
Macrosiphum cerealis Kaltenbach.
Macrosiphum pisi Kaltenbach.
Macrosiphum trifolii Pergande.
Macrosiphum ulmariae Schrank.
Myzocallis ononidis Kaltenbach.
Myzocallis trifolii Monell.
Rhopalosiphum persicae Sulzer.

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Trifolium procumbens.
Macrosiphum trifolii Theobald.
Myzocallis ononidis Kaltenbach.

Trifolium repens.
Aphis bakeri Cowen.
Aphis cephalicola Cowen.
Aphis medicaginis Koch.
Aphis trifolii Oestlund.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Myzocallis trifolii Monell.
Rhopalosiphum persicae Sulzer

Triticum sp.
Brachycolus stellariae Hardy.
Endeis bella Koch.
Schizoneura cerealium Szonizzlo.
Sipha glyveriae Kaltenbach.

Triticum dicoccum.
Aphis avenae Fabricius.
Tychea amycli Koch.

Triticum "sativum".
Liosomaphis rhois Monell.
Macrosiphum cerealis Kaltenbach.
Macrosiphum dirhoda Walker.
Macrosiphum granarium Kirby.
Rhopalosiphum persicae Sulzer.
Toxoptera graminum Rondani.

Triticum spelta.
Macrosiphum cerealis Kaltenbach.
Sipha maydis Passerini.
Toxoptera graminum Rondani.
Tychea trivialis Passerini.

Triticum "villosum".
Macrosiphum cerealis Kaltenbach.
Toxoptera graminum Rondani.

Triticum vulgare.
Anoecia corni Fabricius.
Aphis avenae Fabricius.
Aphis maidi-radicis Forbes.
Aphis pomi DeGeer.

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Brachycolus korotnewi Mordwilko.
Brachycolus tritici Gillette.
Colopha rossica Cholodkovsky.
Macrosiphum cerealis Kaltenbach.
Macrosiphum granarium Kirby.
Macrosiphum trifolii Pergande.
Myzocallis ulmifolii Monell.
Rhopalosiphum persicae Sulzer.
Schizoneura graminis Del Guercio.
Schizoneura venusta Passerini.
Siphocoryne splendens Theobald.
Toxoptera graminum Rondani.
Tetraneura graminis Monell.
Tychea eragrostidis Passerini.
Tychea setariae Passerini.
Tychea trivialis Passerini.

Tropaeolum sp.
Aphis rumicis Linnaeus.

Tropaeolum majus.
Rhopalosiphum persicae Sulzer.

Tropaeolum tricolorum.
Rhopalosiphum persicae Sulzer.

Tsuga canadensis.
Chermes funitectus Dreyfus.
Chermes nordmannianae Eckstein.
Rhizobius subterraneous Kaltenbach.
Schizoneura obliqua Cholodkovsky.

Tulipa sp.
Aphis rumicis Linnaeus.
Aphis tulipae Boyer.
Macrosiphum circumflexa Buckton.
Macrosiphum duffeldii Theobald.
Rhopalosiphum tulipaella Theobald.

Tulipa gesneriana.
Macrosiphum tulipae Monell.
Rhopalosiphum periscae Sulzer.
Rhopalosiphum tulipae Thomas.

Tunica prolifera.
Rhopalosiphum persicae Sulzer.

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Tussilago farfara.
Aphis farfarae Koch.
Aphis pyri Koch.
Aphis vacillans Walker.
Capitophorus similis Van Der Goot.
Macrosiphum tussilaginis Koch.
Macrosiphum tussilaginis Walker.
Phorodon galeopsidis Kaltenbach.
Phorodon inulae Passerini.

Typha angustifolia.
Rhopalosiphum persicae Sulzer.
Siphocoryne nmyphaeae Linnaeus.

Typha latifolia.
Rhopalosiphum persicae Surzer.
Siphocoryne nymphaeae Linnaeus.

Typha shuttleworthii.
Rhopalosiphum persicae Surzer.

Ulex europaeus.
Aphis rumicis Linnaeus.

Ulmus sp.
Aphis gallarum-ulmi Linnaeus.
Eriosoma pyricola Baker & Davidson.
Georgia ulmi Wilson.

Ulmus americana.
Colopha ulmicola Fitch.
Colopha compressa Koch.
Eriosoma americana Riley.
Eriosoma lanigera Haussman.
Eriosoma rileyi Thomas.
Eriosoma ulmi Riley.
Myzocallis ulmicola Thomas.
Myzocallis ulmifolii Monell.
Pemphigus walshii Williams.
Prociphilus fraxini Linnaeus.
Prociphilus venafuscus Patch.
Schizoneura ulmi Linnaeus.
Tetraneura graminis Monell.
Tetraneura ulmi Linnaeus.

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Ulmus campestris.
Callipterus elegans Koch.
Colopha compressa Koch.
Lachnus platani Kaltenbach.
Pemphigus caerulescens Passerini.
Schizoneura lanuginosa Hartig.
Schizoneura ulmi Linnaeus.
Tetraneura alba Ratzeburg.
Tetraneura pallida Haliday.
Tetraneura rubra Lichtenstein.
Tetraneura ulmi Linnaeus.

Ulmus "effusa".
Colopha compressa Koch.
Schizoneura ulmi Linnaeus.
Tetraneura ulmi Linnaeus.

Ulmus fulva.
Pemphigus ulmi-fusus Walsh & Riley.

Ulmus montana.
Tetraneura ulmi Linnaeus.
Tetraneura ulmisacculi Patch.

Ulmus racemosa.
Callipterus bellus Walsh.
Colopha ulmicola Fitch.
Myzocallis quercifolii Thomas.

Ulmus tuberosa.
Tetraneura pallida Haliday.

"Umbelliferae".
Acyrthosiphon navozoi Mordwilko.

Umbellularia californica.
Hyadaphis umbellulariae Davidson.

Urospermum dalechampii.
Macrosiphum hieracii Schrank.

Urospermum picroides.
Macrosiphum hieracii Schrank.

Urtica sp.
Aphis lamii Koch.
Aphis urticae Linnaeus.

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Urtica dioica.
Acyrthosiphon (Microlophium) sibiricum Mordwilko.
Acyrthosiphon (Microlophium) sibiricum kiriz Mordwilko.
Acyrthosiphon (Microlophium) sibiricum sibiricum Mordwilko.
Acyrthosiphon urticae (Microlophium) meridionale Mordwilko.
Acyrthosiphon urticae urticae Mordwilko.
Aphis tertia Walker.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Macrosiphum urticae Schrank.

Urtica holsericea.
Macrosiphum ulmariae Schrank.

Urtica urens.
Aphis rumicis Linnaeus.
Aphis urticae Fabricius.
Aphis urticaria Kaltenbach.
Macrosiphum carnosa Buckton.
Macrosiphum urticae Schrank.

Utricularia vulgaris.
Siphocoryne nymphaeae Linnaeus.

Valeriana sp.
Aphis valerianina Del Guercio.

Valeriana edulis.
Aphis valerianae Cowen.

Valeriana officinalis.
Aphis rumicis Linnaeus.
Aphis viburni Scopoli.
Macrosiphum centhranthi Theobald.
Macrosiphum rosae Linnaeus.
Macrosiphum valerianiae Clarke.

Vanda sp
Cerataphis lantaniae Boisduval.

Veratrum album.
Aphis veratri Walker.

Veratrum californicum.
Aphis verbasci Boyer.

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Verbascum nigrum.
Aphis verbasci Schrank.
Aphis phlomoidea Del Guercio.
Aphis verbasci Schrank.

Verbascum phlomoides.
Aphis veratri Cowen.

Verbascum sinuatum.
Aphis verbasci Schrank.

Verbascum thapsus.
Aphis verbasci Schrank.

Verbena aubletia.
Aphis aubletia Sanborn.

Verbena chamaedryfolia.
Aphis capsellae Kaltenbach.
Aphis verbenae Macchiati.
Rhopalosiphum persicae Sulzer.

Verbena officinalis.
Aphis capsellae Kaltenbach.
Aphis rumicis Linnaeus.
Macrosiphum verbenae Thomas.

Verbena hastata.
Aphis verbena-hastata Rafinesque.

"Veridium".
Aphis cardui Linnaeus.

Vernonia fasciculata.
Aphis middletonii Thomas.
Aphis vernoniae Thomas.
Macrosiphum rudbeckiae Fitch.

Vernonia lindheimeri.
Macrosiphum rudbeckiae Fitch.

Vernonia noveboracensis.
Macrosiphum rudbeckiae Fitch.

Veronica sp.
Myzus veronicae Del Guercio.

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Veronica anagallodea.
Aphis beccabungae Koch.

Veronica beccabunga.
Aphis beccabungae Koch.
Macrosiphum veronicae Theobald.

Veronica chamaedrys.
Aphis veronicae Walker.

Viburnum acerifolium.
Aphis viburnum-acerifolium Rafinesque.

Viburnum latana.
Aphis evonymi Fabricius.
Aphis lantanae Koch.
Aphis sorbi Kaltenbach.
Aphis viburni Scopoli.

Viburnum opulus.
Aphis opuli Sulzer.
Aphis rumicis Linnaeus.
Aphis viburni Scopoli.
Aphis viburni Fabricius.
Aphis viburnicola Gillette.
Aphis viburnum-acerifolium Rafinesque.
Aphis viburnum-opulus Rafinesque.
Myzus ribis Linnaeus.
Rhopalosiphum persicae Sulzer.

Viburnum tinus.
Aphis lantanae Koch.

Vicia sp.
Aphis atronitens Cockerell.

Vicia angustifolia.
Macrosiphum pisi Kaltenbach.
Macrosiphum viciae Kaltenbach.
Macrosiphum ulmariae Schrank.

Vicia cracca.
Aphis craccae Linnaeus.
Aphis craccivora Koch.
Aphis rumicis Linnaeus.
Aphis viciae Fabricius.
Macrosiphum ulmariae Schrank.

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Vicia faba.
Aphis fabae Blanchard.
Aphis fabae Scopoli.
Aphis gossypii Glover.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Macrosiphum viciae Kaltenbach.
Macrosiphum vincae Walker.

Vicia gigantea.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Vicia ludoviciana.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Vicea lutea.
Aphis craccae Linnaeus.
Aphis rumicis Linnaeus.

Vicia narbonensis.
Aphis medicaginis Koch.

Vicia pseudo-cracca.
Aphis rumicis Linnaeus.
Rhopalosiphum persicae Sulzer.

Vicia sativa.
Aphis craccae Linnaeus.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Macrosiphum viciae Kaltenbach.

Vicia sepium.
Aphis tribulis Walker.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.
Macrosiphum vicae Kaltenbach.
Megoura viciae Buckton.

Vicia villosa.
Aphis craccae Linnaeus.
Macrosiphum pisi Kaltenbach.
Macrosiphum ulmariae Schrank.

Vigna catjang.
Aphis rumicis Linnaeus.

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Villarisia sp.
Macrosiphum pallida Walker.

Vinca sp.
Macrosiphum circumflexa Buckton.
Myzus vincae Gillette.
Rhopalosiphum persicae Sulzer.

Vinca major.
Amphorophora latysiphon Davidson..
Macrosiphum convulvuli Kaltenbach.
Macrosiphum vincae Walker.

Vinca minor.
Macrosiphum convulvuli Kaltenbach.
Macrosiphum vincae Walker.

Viola sp.
Neotoxoptera violae Theobald.
Rhopalosiphum tulipaella Theobald.

Viola nuttallii.
Macrosiphum circumflexa Buckton.

Viola odorata.
Aphis gossypii Glover.
Aphis plantaginis Schrank.
Rhopalosiphum persicae Sulzer.
Rhopalosiphum violae Pergande.

Viola tricolor.
Aphis certa Walker.
Aphis dauci Fabricius.
Aphis insessa Walker.
Aphis violae Schouteden.
Rhopalosiphum persicae Sulzer

Vitex agnus-castus.
Aphis viticis Ferrari.

Vitis cordifolia.
Aphis illinoisensis Shimer.
Aphis rivariae Oestlund.
Phylloxera vitifoliae Fitch.

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Vitis vinifera.
Aphis illinoisensis Shimer.
Aphis viticola Thomas.
Aphis vitis Scopoli.
Hyalopterus arundinis Fabricius.
Peritymbia vitisana Westwood.
Phylloxera rutila Dreyfus.
Phylloxera vastatrix Planchon.
Phylloxera vitifoliae Fitch.
Phylloxera pemphigöides Donnadieu.
Rhizoctonus ampelinus Mokrzhetsky.
Schizoneura ampelorhiza Del Guercio.

Vitis vulpina.
Aphis illinoisensis Shimer.
Aphis ripariae Oestlund.
Aphis vitis Scopoli.
Aphis viticola Thomas.
Phylloxera vitifoliae Fitch.

Vulpa sp.=Festuca sp.?
Aphis vulpiae Del Guercio.

Xanthium sp.
Anuraphis xanthii Del Guercio.

Xanthium canadense.
Aphis maidi radicis Forbes.
Siphocoryne xanthii Oestlund.

Xeranthemum sp.
Aphis intybi Koch.

Yerva mora.
Aphis morae Kittel.

Yucca sp.
Aphis yuccae Lichtenstein.
Myzus roseus Macchiati.
Myzus rubrum Macchiati.

Yucca glauca.
Aphis yuccae Cowen.
Aphis yuccicola Williams.

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Zea mays.

Anoecia corni Fabricius.
Aphis maidis Fitch.
Aphis maidi-radicis Forbes.
Aphis papaveris Fabricius.
Aphis rumicis Linnaeus.
Aphis zeae Bonafous.
Aphis zeae Curtis.
Endeis bella Koch.
Forda occidentalis Hart.
Geoica squamosa Hart.
Macrosiphum granarium Kirby.
Mindarus panicola Thomas.
Pemphigus brevicornis Hart.
Pemphigus radicum Boyer.
Rhizobius pilosellae Burmeister.
Rhizobius spicatus Hart.
Rhizoterus vacca Hartig.
Rhopalosiphum persicae Sulzer.
Schizoneura venusta Passerini.
Sipha flavus Forbes.
Sipha maydis Passerini.
Tetraneura ulmi Linnaeus.
Toxoptera graminum Rondani.
Tychea erigeronensis Thomas.
Tychea setariae Passerini.

Zizia aurea=Thaspium aureum.
Siphocoryne pastinaceae Linnaeus.

Zizyphus jujuba.
Rhizobius jujubae Buckton.

Zygadenus nuttallii.
Macrosiphum martini Cockerell.

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THE INFLUENCE OF FRENCH FARCE ON THE TOWNELEY CYCLE OF MYSTERY PLAYS

LOUIS WANN

Of the three or four main problems that confront the student of the Towneley cycle of English mystery plays, by far the most interesting and at the same time the most difficult of solution is that concerned with the many influences that went to their composition. It is true that the more obvious actual sources of most of the plays have by this time been fairly well determined, and the successive labors of Davidson, Hohlfeld, Pollard, Cady, Craig, and others[1] have made possible at least a reasonably approximate estimate of the manner in which this important cycle as a whole was developed. Yet not a little remains to be done. For it is of that very group of plays which give Towneley its peculiar power and interest that we know the least concerning the influences which contributed to their making. Of the three now generally recognized stages in the evolution of the cycle (the liturgical stage, the York stage, and the Wakefield stage), it is the last period, when the "genius of Wakefield" placed the stamp of his originality upon the cycle, about which are in doubt. The peculiar status of this group of plays, concerning which we at once desire the most and possess the least knowledge, is readily apparent from a brief resumé of the special classes of sources to which the plays of the cycle are indebted.

The sources of Towneley divide themselves naturally, almost inevitably, into three main classes, corresponding, in a rough way, with the three main stages in the development of the cycle

[1] To the general school of opinion represented by Pollard belong also, allowing for minor differences, Bunzen, Gayley, and Chambers.

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already referred to. These classes are: the religious sources, the York sources, and the secular sources. The religious sources comprise the following: liturgical plays, whose influence in the formation of the cycle was of course very important[2]; the liturgy itself, whose influence in this cycle is slight;[3] the *Vulgate,* the most important of all the religious sources, since its influence is strongly felt in all but four plays and parts of five others;[4] the *Apocrypha,* whose influence in Towneley is very slight;[5] and, finally, other religious literature, including the *Cursor Mundi,* the *Pricke of Conscience,* the *Northern Passion,* the *Speculum Christiani,* and numerous Middle English prayers and lyrics.[6] Of the religious sources the Vulgate and liturgical drama are by far the most important and considerable in their influence upon the formation of the cycle.

The second class of sources, the York plays, form for the most part a fairly clear-cut group. There is no doubt as to the direct borrowing of five plays from the York cycle, namely the plays of *Pharaoh, The Doctors, The Harrowing of Hell, The Resurrection,* and *The Judgment* (from the corresponding five plays in York, numbered 11, 20, 37, 38, 48). Furthermore, it is quite certain that parts of four others, *The Offering of the Magi, The Flight into Egypt, The Conspiracy,* and *The Scourging,* are derived from various parts of the York cycle.[7] Finally, there are parts of eight other plays which show slight resemblance to York but upon which scholars are not agreed as to the influence of York upon Towneley.[8] The York influence, then, is considerable and within limits beyond any question. It remains true, however, that except for one or two plays York did not add to Towneley much of distinct power or importance.

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[2] Liturgical plays influenced parts of or the whole of plays 1–8, 10–16, 20–23, 25–32. Play 4 *may* be in part from the *Mystère du Viel Testament.* See Huglenin, Julian, *An Interpolation in the Towneley Abraham Play,* MLN., XIV, 255.

[3] The liturgy contributed in a very scattered manner to plays 1, 3, 7, 11–14, 17–18, 23, 25–26.

[4] The Vulgate contributed strongly to all but plays 7, 25, 30 and 32, and parts of plays 2, 3, 9, 12 and 13. Play 7 (probably a liturgical play) has not yet been traced to its source in the Vulgate.

[5] The Apocryphal sources were influential only in plays 10, 23 and 25.

[6] The *Cursor Mundi* influenced plays 7 and 32; *The Pricke of Concience,* play 30 (beginning); *The Northern Passion,* plays 20, 22, 23, 26; the *Speculum Christiani,* play 18; Middle Eng. Prayers and Lyrics, plays 12, 17–19, 26–28, 30–31. On this last influence see Taylor, G. C., *Mod. Phil.* V, 1–38.

[7] Compare the conclusion of Hohlfeld, Bunzen, Pollard and Gayley on this class as well as on the liturgical class of sources.

[8] Towneley plays 10, 16, 17, 23, 26, 27, 29, 32.

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On the whole, then, we are right in saying that the religious influence accounts in large measure for the first stage in the development of Towneley, the group of didactic or liturgical plays which make up the bulk of the cycle, though of inferior interest. The York influence accounts for the second stage, marked by imitation, comprising a less considerable group of plays, though of slightly more interest and worth.

There remains the third class of sources, namely the secular or profane sources. As I have already pointed out, it is this class about which least is known and most is desired. Of the group of plays containing material whose presence is due neither to the religious nor to the York influence, there are ten, namely: plays number 2 (the Garcio and Cain episode); 3 (Noah and his wife); 12 (the dinner of the shepherds and their attempt to sing); 13 (the farce of Mak the sheep-stealer); 16 (the bout between the soldiers and the women); 21 (the passion of Caiphas and the rough play jof the tortures); 22 and 23 (the rough farce of the torturers); 24 (the dicing scene); and 30 (Tutivillus and the demons). Of these ten, whose sources for the secular material must almost certainly be secular since the action is decidedly secular, we have clear sources for parts of only two plays, namely the *First Shepherds' Play* and the play of *The Judgment*. In *Prima Pastorum* the farcical episode of the shepherds quarreling over the imaginary sheep is almost certainly a dramatization of an English folk-tale, one version of which is found in Tale No. 1 of "The Merry Tales of the Mad Men of Gotham," printed by W. Carew Hazlitt in his *Shakespeare Jest Books*.[9] The reference to Moll and her Pitcher in the same play is to one of a multitude of tales about the Milkmaid and her Pitcher of Milk current throughout Europe and known to modern readers in La Fontaine's fable of Perrette.[10] Here again is an instance of the dramatist's use of common property, property which must have been just as common to Englishmen as to Frenchmen. The play of *The Judgment* contains some satire on women which has been

[9] The only other extant version may be seen in the same author's "A Hundred Merry Tales" folio VIII, obverse, London, 1887. See Eaton, H. A., *Mod. Lang. Notes* XIV. 265-8. Another possible source for the secular material of this play (ll. 215-39) is a Middle English collection of "Grotesque Receipts".

[10] *Fables de La Fontaine*—par M. Félix Lemaistre, Paris, p. 183 (Livre VII, Fable X). See Gerould, G. H., *Mod. Lang. Notes* 19: 225-30.

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traced to the general class of Middle English Satires on women very accessible to the dramatist of the fourteenth century.[11] The fact that the only sources so far found for these secular episodes are either English or the common property of Englishmen and others is of much importance in connection with the endeavor to find the sources for the remaining plays whose sources have till now remained unidentified. The ten plays above-mentioned, then, contain material, secular or farcical in nature, whose source has defied identification.

In the attempt to account for these farcical elements, all of which by the way are attributed to the one author (the genius of Wakefield) we should turn first of all to England itself. And upon examining the English drama of the period, we readily find *parallels* for seven of these ten scenes in either the cycle or non-cycle plays of England. These parallels may be conveniently tabulated as follows:

Towneley 2 = York 7; the Croxton play of The Sacrament.
" 3 = " 9; Chester 3; Newcastle.
" 12 = 15; Chaster 7; Newcastle. (Shearmen and Tailors')
" 13 = no parrallel.
" 16 = cf. York 9; Towneley 13; Chester 3; Newcastle.
" 21 = York 31; Cornish.
" 22 = cf. York 31.
" 23 = cf. York 31.
" 24 = no parallel.
" 30 = no parallel.

With the sources substantially determined for all but ten plays (and it will be noted that these sources were either common property of all Europeans or definitely English in origin), and with English parallels found for the secular elements of seven of the Wakefield group of ten, there remain but three plays whose secular elements have hitherto found neither source nor parallel in England. These are: the farce in *Secunda Pastorum*, the dicing scene in the play of *The Talents, and* the

[11] Play 23 may also have been influenced by the same source.

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Tutivillus scene in the play of *The Judgment*. Of these three, the farce of Mak the sheep-stealer is far and away the most important; and if the source of this play could be determined, we should be justified in feeling that the secular influences in the Towneley cycle had been practically determined. It is to the consideration of supposed sources and parallels for this play that we may now direct our attention.

With the exhaustion of all known English parallels and sources for the farcical elements of Towneley (omitting merely the modern parallels to *Secunda Pastorum* which will be discussed later), we should naturally turn to the continent, and most particularly to France, where during a period of about 150 years, from about 1400 to 1550 or later, the type known as the farce flourished, for which we have approximately 150 extant speciments in addition to about 100 pieces of types allied to the farce. It was Jusserand who first noticed the resemblance between the farce in *Secunda Pastorum* and the incomparable French farce of *Maistre Pierre Pathelin*.[12] But it remained for Dr. A. Banzar, about thirty years ago, to make a detailed comparison of the two works and claim *Pathelin* as the source of the farce of Mak.[13] So far as I am aware, the claims of Dr. Banzer have never been openly challenged Indeed, his conclusions, based in a very detailed comparison of the two plays, seem to have received neither approval nor rejection. That the way may be cleared for further investigation, it would seem desirable to examine Dr. Banzer's theory with the care which it deserves, and so accord it either the approval or the rejection which every seriously proposed theory should receive.

For purposes of clearness, the plots of the two plays entire may be very concisely summarized before an examination of Banzer's claims. The contents of the entire *Secunda Pastorum* are as follows:

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[12] Jusserand, J. J. *Le théâtre en Angleterre* (1881), p. 93: "L'episode n'a rien de biblique et rapelle le ton de l'avocat Pathelin."

[13] *Die Farce Pathelin und ihre Nachahmungen, Zeit für neuf. Sprachen u. Litt.* X, 93-112. See also *The Influence of French Farce upon Plays of John Heywood* (*Mod. Phil.* II, 97-124) by my colleague, Prof. Karl Young, to whom I am indebted for the suggestion of this study.

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13. *Incipit Alia eorundem.* Three shepherds enter separately, each complaining: the 1st of the cold weather and the poverty of shepherds, the 2nd of the weather and the hardships of wedded life, the 3rd, of the world's bitterness, the floods, etc. The 1st and 2nd meet and are encountered by the 3rd; they all converse, then they sing, taking tenor, treble, and mean; Mak (the sheep-stealer) enters and is accused of being out to steal sheep; after Mak's comment on wedded life, the shepherds lie down to sleep, placing Mak between them; Mak rises, says a mock night-spell, and goes home with a stolen sheep; he and his wife Gyll put the sheep in the cradle, and Mak returns to the shepherds, who awake, waken Mak, and go off to count their sheep, promising to meet "at the crooked thorn." Mak goes home, Gyll grumbles, but they plot to escape detection; Gyll is to be ill in childbed, the sheep in the cradle is the new-born child, and Mak is to induce the shepherds to go away; the shepherds meet, realize their loss, and go to Mak's home to find the stolen sheep; after some search, they are about to leave, believing they were mistaken; but one shepherd, desiring to offer the baby a gift, discovers the trick; they toss Mak in a blanket; they lie down to rest; an angel bids them arise and announces Christ's birth; they discuss the angel's music and hasten to Bethlehem; they offer Christ a lot of cherries, a bird, and a ball; Mary promises to pray her Son to protect them, and they leave singing.

In like manner the main outlines of the farce of *Pathelin* are as follows: Pathelin (a poor lawyer) and Guillemette (his wife) lament their poverty and rags. Pathelin declares to Guillemette that he will secure cloth for them both with which to clothe themselves. He goes to the draper's shop and through flattery and a false promise to pay later succeeds in carrying off a bolt of fine cloth. Arrived home, Pathelin delights Guillemette with the cloth, and they plot to evade payment to the draper when he calls for the money. Pathelin gets in bed, with the cloth under his pillow, and is to feign serious illness. Guillemette receives the draper when he calls for the money, pretends Pathelin has been ill for six weeks, and begs the draper

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not to distrub him. The draper is at first insistent, but when Pathelin gets out of bed and plays the part of the delirious patient, the draper is so non-plussed that he fears he has made a mistake and returns to his shop. Pathelin and Guillemette exult over their success, but the draper returns and insists once more on payment. This time Pathelin goes into a perfect tantrum, playing the witch, impersonating a priest, and talking a gibberish of Breton, Limousin, Picardy, Norman French, etc. Completely worn out, he is put to bed by the draper and Guillemette, and the draper leaves, hoodwinked for good.

Here the resemblance to the Mak farce ends, for the ensuing story of the draper's shepherd, who retains Pathelin to defend him against the draper and who beats Pathelin out of his fee by implicitly following the lawyer's injunction always to say "baa" to any question asked of him by anyone whatsoever, finds no place in the English masterpiece. A tabular view of the contents of the two plays will show the extent of the parallel more clearly, particularly the absence from *Secunda Pastorum* of the entire second part of *Pathelin:*

Secunda Pastorum	*Pathelin*
ll. 1-171—Laments of three shepherds	———
172-189—Preparation for song	.....
190-628—The Mak farce	1-1006—First part of *Pathelin*
.....	1006-1600—Second part of *Pathelin*
629-637—Preparation for sleep	.....
637-754—The angel's announcement and the adoration	.....

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Banzer's argument rests largely on the striking parallel between the main action of the two farces, supported also by numerous parallels in small details. In his own words: " Die Ähnlichkeit zwischen der alten Farce Pathelin und der vorliegenden Stück liegt hier in der geschichten Weise mit der die Nachforschungen nach dem entwendeten Gut vereitelt werden sollen und in der Ausführing derselben. Wir finden auch in den kleinen Characterzügen auffallende Übereinstimmung."[14] Then follows a list of detailed parallels which we may summarize succinctly as follows, the material within the brackets being additions of my own:

(1) Pathelin and Guillemette lament the state of the household (11. 1–4 and 29–32)
Mak complains about the cares of his family and their maintenance (11. 237–8 and 244–6)

(2) Pathelin is glad over his cloth, and Guillemette is so astonished she knows not whether to believe him or not (11. 352–5) [and ff].
Mak is also glad over his booty, and Gyll is likewise astonished (11. 305–6; 309–14; 316; 324)

(3) Both Guillemette and Gyll becomes anxious and think of the punishment to befall them, but they are both calmed (*Path.* 11. 357; 361; 362–3; 377–81; 481–90. *Sec. Pas.* 11. 315–22; 325–31)

(4) Both Guillemette and Gyll finally lend their aid and agree upon the plan to fool the victims and save themselves (*Path.* 11. 460–70; 496–7. *Sec. Pas.* 11. 332–8; 442–6)

(5) Both the women promise to do their best (*Path* 11. 478–9 493–5. *Sec. Pas.* 11. 431–4; 447–8)

Here the rôles are interchanged, Gyll going to bed as does Pathelin, Mak receiving the shepherds as Guillemette receives the merchant.

(6) Mak asks the shepherds to speak low and finally tries to touch their souls with pity. So Guillemette with the merchant (*Path.* 11. 512–21; 598–9; 672–3. *Sec. Pas.* 11. 519–20; 528–9; 531–3; 539–40) [484–6]

(7) Gyll and Pathelin are both restless in bed (*Path.* 11. 610–13; 616–19 etc. *Sec. Pas.* 11. 525–7; 530; 534–8)

[14] *Zeit. für neuf. Sprachen u. Litt.* X, 106.

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(8) Both the shepherds and the merchants are too convinced of the fact of the deed to leave at once (*Path.* 11. 654–6. *Sec. Pas.* 1. 541)

(9) Pathelin at last succeeds in shaking the merchant's conviction, just as Gyll makes the shepherds want to atone for their trespass [*Path.* 706–31] (*Sec. Pas.* 544–54)

Banzer then concludes that the "Dialog, Aufbau, Handlung, und die Zeichnung von Gyll und den Schäfern" point unmistakably to *Pathelin* as the original,[15] and even adds to this conclusion the striking statement that because of this proved relationship the English miracle plays rest upon French originals.[16] He admits the absence from *Secunda Pastorum* of the entire second part of *Pathelin,* and he admits the difference between the two caused by the mixing of the rôles, Gyll taking Pathelin's part, and Mak that of Guillemette.[17] He assumes that there is no difficulty in placing *Pathelin* early enough (1388–92) to allow of its being the source of *Secunda Pastorium,* and he accounts for the absence of characteristic scenes from *Pathelin* by supposing either that the author of the English play used an earlier and simpler version than we now possess, or that he feared he would be digressing too far from the liturgical story if he used more farcical material. He admits, however, that there is no ground for omitting the delirum scenes.

So much for Banzer's claims. While there is at first glance much plausibility in these claims, closer examination reveals their insecure basis. There are three decisive reasons for opposing the above conclusions, almost any one of which is sufficient of itself, but all of which taken together afford irrefutable evidence, it seems to me, for rejecting *Pathelin* as the source for *Secunda Pastorum.* These reasons are:

(1) A careful comparison of the above table of parallels, supplemented by a comparison of the characters and the tone of the two farces, reveals numerous striking differences, all of which cannot reasonably be accounted for if the English author were influenced by *Pathelin.* In the first place, some of Banzer's parallels are more apparent than real. Numbers 2, 5, and

[15] *Ibid,* p. 110.
[16] *Ibid.,* p. 111.
[17] *Ibid.,* p. 111.

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6 are good parallels. Number 3 is good except that Guillemette really questions Pathelin longer than Gyll does Mak. Number 4 affords a parallel, except that Pathelin proposes the plan in the one case and Gyll in the other, thus interchanging the rôles. Following number 5 is another interchange of rôles, Mak and Guillemette respectively receiving the victims. Numbers 7 and 9 indicate parallels, though in number 7 Pathelin carries the business much farther, and in number 9 it takes Pathelin longer to convince the draper than it does Gyll. In number 8 there is no indication that the shepherds are convinced of the facts as is the draper, though there is some parallel. Finally, in number 1 Mak complains not so much of family cares as of his *wife*. Furthermore, he wants *food*, whereas Pathelin and his wife want *clothes* especially. These differences are too significant to be passed by, especially (1) the comparative meagerness of development in *Secunda Pastorum*, where one would expect fuller development if *Pathelin* were the original, and (2) the interchange of rôles. Furthermore, the absence on any extended scale of the capital delirium scenes, the absence of any hint whatever of the second part of *Pathelin*, which would afford the very best of "shepherd" material for a play, and the complete reversal of the conclusion (the draper failing where the shepherds succeed)—these and numerous minor differences in characterization argue against any close relation between the two.

(2) The late date of *Pathelin* is, so far as our knowledge now goes, an insurmountable obstacle. According to the consensus of opinion,[18] *Pathelin* can hardly be earlier than 1450. Present-day conservative opinion is perhaps best represented in the following words of Petit de Julleville: "La date de ce chef-d'oeuvre est___facile a fixer. Pathelin dut voir le jour vers 1470. Avant cette epoque, il n'en est pas question et le nom est inconnue; a partir de cette date, Pathelin est nommé partout et il est fait sans cesse allusion."[19] On the other hand, no one has ventured to place *Secunda Pastorum* later than about 1420.[20] Around 1400 would be a more conservative estimate. And until

[18] See, for summary of opinion on this question, Schumacher, Joseph, *Studien zur Farce Pathelin*, pp. 21–28.

[19] *Le Théâtre en France* (1893), p. 48.

[20] See, especially, an article by Traver, Hope, on *The Relation of musical terms in the Woodkirk Shepherds Plays to the dates of their composition* in *MLN* 20, 1–4. This writer places *Sec. Past.* at about 1400 "or a little later".

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we have evidence that *Secunda Pastorum* was very much later, or that *Pathelin,* in this or some earlier form, was very much earlier, it would seem impossible to admit that *Pathelin* influenced the English farce.

(3) The fact that practically all of the other farcical elements in the Towneley cycle have either English sources or English parallels, and that we possess in a late English form an English folk-tale much nearer to *Secunda Pastorum* than is *Pathelin,* makes an English origin for the play much more likely than a French origin. I have pointed out that all but three of the ten farcical passages in Towneley have either English sources or parallels. Moreover, two of these passages are dramatized folk-tales current in England. May the farce of Mak not likewise be a dramatization of an earlier form of *Archie Armstrong's Aith,* identical with the Mak farce except for the conclusion?[21] This supposition is strongly supported by still another parallel recently discovered by Prof. A. S. Cook and described by him in *Modern Philology,* XIV, 11–15. In this case it is Thomas Armstrong, an actual character living in the latter half of the eighteenth century, to whom is attributed the same trick in concealing the theft of a pig as Mak attempted with the sheep, namely, hiding it in a cradle. Whether the trick was actually perpetrated or whether it is a case of some old folk-tale getting itself attached to an individual, matters little. We have here the episode embodied in two forms in England itself, and the probability is more than a reasonable one that the farce of Mak is based upon just such native material as we have before us in modern form.

If, however, we cannot admit *Pathelin* to be the source of *Secunda Pastorum,* may there not be some other French farce or at least some farcical material which might have served as a source or at least be a parallel? To satisfy myself whether this could be true, I have made a careful examination, first, of the complete *Répertoire du Théâtre Comique en France au Moyen Age* (1886) of Petit de Julleville, and second, of the same author's *Les Mystères* (2 vols. 1880), in both cases with an eye to

[21] See the article by Kölbing, E., in the England–Pollard edition of the Towneley plays, p. XXXI.

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any farcical material containing either shepherd scenes similar to that in *Secunda Pastorum* or non-shepherd scenes with plots similar to those of *Secunda Pastorum* and *Pathelin*. Furthermore, I have examined the texts themselves of those plays whose analysis in the above répertoires gave any promise of such parallels being found.[22] The results of this examination were surprisingly meagre.

Of 253 extant moralitiés, farces, sotties, monologues and sermons joyeux listed by Petit de Julleville only ten contain matter that is at all reminiscent of the farcical material in *Secunda Pastorum* or *Prima Pastorum*. These ten pieces are distributed as follows: moralités, 4 (P. deJ. nos. 21, 24, 48, 58); farces and sotties, 3 (P. deJ. nos. 74, 135, 150); monologues and sermons joyeux, 3 (P. de J. nos. 215, 221, 230). There is no indication of any parallel in the list of non-extant pieces, in the surviving notes on stage representations of comic drama, or in the list of non-dramatic pieces excluded from the other lists. In the same author's analyses of French mystères there are found in the long list of plays: none of the 12th or 13th century, only one of the 14th (vol. II, 254–5), only ten in the 15th century (II,, 362–3; 388; 401–4, 408; 412; 417; 430; 433, 436; 436; 495; 513), and none in the 16th which contain material of a farcical nature resembling that in the Towneley shepherd plays.[23]

An examination of the above-cited passages leads quickly to the conclusion that outside of the imitations of *Pathelin* itself, which of course come still later than *Pathelin*, there is nothing in French medieval drama in the slightest degree approaching the plot structure of the Mak farce. Furthermore, there is no one of the above-cited resemblances to incidents in *Secunda Pastorum* which cannot be duplicated in other English cycle or non-cycle plays. The conclusion seems irresistible that, if we are to find the source of the farcical material in the Wakefield group of the Towneley plays, we are not likely to find it in

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[22] The main collections and separate texts examined are as follows: Jacob. P. L., *Recueil de Farces, Sotties et Moralités du XVe siècle* (1859); Fournier Ed., *Le Théâtre français avant la Renaissance* (1872); Viollet le Duc, E., *Ancien théâtre français* (1854); the texts of the Societé des Anciens Textes français (for the mystères, particularly).

[23] Owing to the requirements of space a detailed examination of this dramatic material is reserved for a separate article which I hope to publish in the near future.

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French farce or, for that matter, in any other form of French drama. We are likely to find it, not on French soil, but in England itself where the sources for the rest of the cycle material have been found.

Neither source nor satisfactory parallel to Play 13 has yet been discovered outside of England. Of the other two plays, for whose farcical elements we still lack sources or parallels (Plays 24 and 30) a brief word may be said in conclusion. It is possible that French parallels or even sources may yet be found for the farcical elements in these plays. Certain it is that parallels exist in the dramatic literature of Germany practically contemporary with the Towneley cycle.[24] It is doubtful, however, if there could have been any intimate connection between the respective plays in question. And even though this should be the case, the farcical material is of so slight an importance compared with that in the remaining eight plays of the cycle, for all of which we have English parallels, that the establishment of any relationship would not affect seriously the general conclusion that, for the secular sources of the Towneley plays we must look to the literature and life of the English people themselves.

Note:—This paper was already in type when Dr. A. C. Baugh's interesting article on *The Mak Story* appeared in *Modern Philology*, April, 1918, pp. 169 ff. His discovery of a fifteenth century Italian analogue in the forty-second novella of *Le Porretane* by Giovanni Sabadino degli Arienti, though first published in 1483 and probably not composed before 1475, confirms my own conclusions regarding the literary connections between the Mak farce and the farce of *Pathelin*. In his own words (p. 173): "If then, as we believe, the incident can lay claim to no historical foundation, we are forced to conclude that it belongs to the province of folklore." Thus the English Mak story, the French farce, and the Italian novella are simply, so far as our present interest is concerned, separate and varied embodiments of a common theme of European folklore—the adoption of a trick to conceal a theft.

[24] For this information I am primarily indebted to an excellent unpublished study by Miss Sarah M. Beach.

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THE PREPARATION OF SELENIC ACID

H. H. MORRIS

Selenic acid was first prepared by Mitscherlich in 1827.[1] He decomposed lead selenate suspended in water, by hydrogen sulfide. In 1830 Berzelius[2] suggested the oxidation of an alkali selenite by means of chlorine, for the preparation of selenic acid. In 1834[3] Ballard used hypochlorous acid for the oxidation. In 1840, Rose[4] suspended selenium in water and passed in chlorine which oxidized it to selenic acid. Wohlwill[5] in 1860 used potassium dichromate, lead dioxide, and manganese dioxide as oxidizing agents in the preparation of the acid. In the same year von Hauer[6] prepared selenic acid by the decomposition of cadmium selenate with hydrogen sulfide. Nine years later Thomsen[7] made what was claimed to be very pure selenic acid by treatment of silver selenite with bromine.

Thomsen took no steps to remove any selenious acid which might be present, and from the present work it seems that his preparation could not have been quite pure.

Von Gerichten,[8] working in 1873, used a method very similar to that of Mitscherlich. In 1899 Cammeron and Macallan[9] published their work on the concentration of selenic acid and showed that it could be obtained in the anhydrous condition. They constructed tables of the specific gravity and percentage strength of the acid, which were very good for the range covered, but which were later made complete by the work of Lenher and Diemer.[10]

[1] Ann Ph Ch Pogg **9**, 623.
[2] Berzelius Lehrbuch Bd III, s 16 der 4ten deutschen Auflage.
[3] Ann Ph Ch Pogg **57**, 225.
[4] Ann Ph Ch Pogg, **45**, 337.
[5] Ann Chem Pharm Lieb **114**, 169.
[6] Sitz Akad Wein **39**, 399.
[7] Ber **2**, 598.
[8] Ann Chem Pharm Lieb, **168**, 214.
[9] C N **59**, 219 232, 258, 267.
[10] Jr Phsic Chem **13**, 505.

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In 1882, Mulpert[1] made selenic acid by the oxidation of selenium with ozone. Metzner[2] in 1898, showed that the reaction of chlorine on selenious acid is exothermic. The chlorine works best with about a ten percent solution of the dioxide. When chlorine is in excess the oxidation is complete, but if bromine is substituted in the reaction more heat is given off, and it requires somewhat of an excess of bromine to complete the reaction. The theoretical amount of bromine shows a red color in the solution, but all the selenium dioxide is not oxidized. Metzner further proposed a method of oxidation by permanganic acid, which he states gives good selenic acid. Another method of his depends on the electrolytic decomposition of copper selenate.

Other methods that have appeared depend either on the oxidation of selenious acid [3 4], a selenite[5], or selenate[6] by means of the electric current, or the oxidation of selenious acid with hydrogen peroxide.[7]

From the foregoing it appears that many methods for the preparation of selenic acid have been described; several of which seem to be fairly simple. Actually, however, many of the essential details are lacking, even though upon them depends the success of the method.

The method of J. Thomsen will yield excellent selenic acid under correct conditions, but it was only through repeated failures to obtain a stable preparation of the acid that these conditions were recognized and the causes of failure eliminated.

The main points to be observed are as follows: The preparation of silver selenite requires pure selenium dioxide. The bromine used to convert the silver selenite into selenic acid must be free from reducing substances. All dust must be rigorously excluded throughout the preparation.

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[1] C. R. **94**, 1186.
[2] C. R. 127, 54.
[3] Chem Ztg **31**, 360.
[4] Gazz chim Ital **39**, I 50.
Chem Zentr 1909, I 721.
[5] Ber **36**, 4262.
[6] Jr Am Chem Soc **30**, 1374.
[7] Ber **48**, 1154.

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Selenium dioxide of excellent quality is prepared in the following manner: Selenium is dissolved in nitric acid, specific gravity 1.2, and the solution evaporated to dryness. The impure dioxide resulting is heated to a temperature just below that at which it will sublime in order to remove the excess of nitric acid. After the dioxide is dissolved in water, barium hydroxide is added until no further precipitate of barium sulfate forms. This is filtered off, and the solution again evaporated to dryness.

Selenium dioxide does not melt under atmospheric pressure, but may be sublimed as pure white needle shaped crystals, which are commonly several inches long.

During the sublimation very small amounts of impurities such as dust from the air, or lint from the towels used in cleaning the apparatus will reduce the selenium to its red form, thus contaminating the sublimate. Frequently the crystals are half red and half white so that a separation is impossible.

In case the quantity of impurities is such that a white sublimate can not be obtained easily, the selenium should be further purified in the following manner. The solution of the dioxide in water is acidified with hydrochloric acid, warmed, and treated with sulphur dioxide. The precipitated selenium is filtered on an asbestos felt, washed with water, dissolved in nitric acid, and treated as previously described. When free from reducing materials the selenium dioxide sublimes white.

A convenient apparatus for sublimation consists of an evaporating dish in which are placed three funnels fitting one inside the other. Slow sublimation is most efficient. Sublimation in a current of oxygen has been recommended, but this is not necessary.

The bromine on the American market was found to contain impurities of a reducing character which make it absolutely unfit for use in the preparation of selenic acid without careful purification. Bromine is such an unusual source of reducing materials that its quality may easily escape question. The stability of the selenic acid, however, is largely dependent on the purity of the bromine.

The interfering substances are removed from the bromine by treatment with a mixture of chromic and sulfuric acids and by subsequent distillation. The bromine, after standing with the acids for several days or until the evolution of carbon di-

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oxide has ceased, is separated from the green residue that forms, and is distilled with fresh portions of the chromic and sulfuric acids. Only small amounts of the acids should be present during the distillation, as large quantities cause dangerous bumping. The still must be so arranged that no material but glass comes in contact with the bromine. Only the middle portion of the distillate is collected for use, and must be free from chromium and sulfuric acid. The presence may be detected by dissolving a few cubic centimeters of the bromine in dilute ammonia, boiling to precipitate any chromium present in the reduced condition, which would appear as hydrated chromic oxide, making acid with acetic acid, and adding barium chloride to show the presence of sulfuric acid or chromium as chromate.

Having obtained pure selenium dioxide and pure bromine, the next step is the formation of silver selenite. All glass coming in contact with the preparation is cleaned with a mixture of chromic and sulfuric acids, and the water used is distilled from potassium permanganate and sodium hydroxide.

A ten percent aqueous solution of the dioxide is treated with a slight excess of silver nitrate solution. Silver selenite precipitates as a white crystalline salt. This is washed by decantation until it is absolutely free from silver nitrate and nitric acid. If nitric acid is allowed to remain in the silver selenite, it decomposes the hydrogen sulfide used later thus contaminating the selenic acid.

The silver selenite is suspended in water, and bromine added in small portions with vigorous shaking after each addition, until the red color of the solution indicates that an excess of bromine has been added. The solution is then placed on a steam bath for at least twelve hours to complete the oxidation and coagulate the precipitate. During all these operations care must be taken to exclude dust. The silver bromide is filtered off on well cleaned glass wool.

The filtrate is concentrated by distilling off the bromine and water under reduced pressure. The distillation apparatus is so arranged that no corks, or rubber stoppers, come in contact with the acid. A Jena glass retort, sealed to a water jacketed condenser which in turn is connected to a suction flask and pump, serves the purpose very well. A few glass beads placed in the retort prevent bumping.

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The concentrated acid is drawn from the retort into a large wash bottle, care being taken to avoid drawing air through the solution. Well washed hydrogen sulfide is next passed through the acid until precipitation is complete, and the precipitate has become flocculent. The excess of hydrogen sulfide is then blown out by a stream of air from which all dust has been removed by bubbling through concentrated sulfuric acid.

The hydrogen sulfide serves to remove any selenious acid which may be present, decomposing it with the precipitation of sulphur and selenium. This precipitate is removed by filtering through an asbestos felt.

It is frequently stated that selenic acid is not acted upon by hydrogen sulfide, but after each concentration of the acid, hydrogen sulfide produces a light precipitate. That this is not due to the decomposition of selenic acid by heat is shown in the following manner: Selenic acid free from selenious acid and giving no precipitate with hydrogen sulfide is concentrated at room temperature in a vacuum desiccator over sulfuric acid or sodium hydroxide. This acid as it becomes more concentrated will give a precipitate with hydrogen sulfide.

By these experiments it is shown that the method of J. Thomsen will give excellent selenic acid if particular attention is given to certain details of the process.

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THE FAUNA OF LAKE MENDOTA:

A QUALITATIVE AND QUANTITATIVE SURVEY WITH SPECIAL REFERENCE TO THE INSECTS

RICHARD ANTHONY MUTTKOWSKI

Notes from the Laboratory of the Wisconsin Geological and Natural History Survey. XI.

INTRODUCTION

The present paper deals with the macroscopic fauna of Lake Mendota. In the fall of 1913 Mr. C. Juday for the Wisconsin Geological and Natural History Survey proposed the following problem to the writer, "A quantitative study of the insect fauna of Lake Mendota as a source of fish food." Certain phases of the ensuing investigations are incorporated in the present paper.

I am indebted to Professors W. S. Marshall and A. S. Pearse, and to Mr. C. Juday for their constant advice, aid, and helpful suggestions; I am also beholden to them and to Professors W. N. Steil, R. H. Denniston, G. M. Smith, and J. J. Davis for faunal and floral determinations, and I take this opportunity to extend my sincere appreciation and thanks for many kindnesses.

Apparatus and Methods.—The Wisconsin Geological and Natural History Survey provided the writer with a row boat and detachable motor. The motor made it possible to reach even the most outlying portions of the lake in less than an hour and to work with the greatest dispatch. Dip-nets, aquatic nets of various kinds, rake-nets, dredge, sifting pan, bottles, rubber boots, tape-line, thermometer, sounding line, and note book formed the chief collecting paraphernalia.

In general, a "square meter" method was employed in col-

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lecting. A square meter was laid out; the surface layer of the bottom and the fauna and flora within the area were gathered as completely as possible, placed in a sifting pan, the plants sorted over, and the whole sifted down to the compass of a liter jar (quart jar). Two to three stations,—that is, points, selected at random, each within one of the fifty areas (see fig. 1) into which the lake was divided,—were visited on a trip; the "hauls," each covering a square meter of bottom, were taken at successive depths. After all the jars were filled in the field, they were taken to the laboratory where the organisms were sorted and counted while still alive and active; the sorting of "dead" collections offered too formidable difficulties to be attempted, for so many of the recognition characters of living specimens, such as position, method of locomotion, and color, are lost in dead material.

Some reference seems appropriate as to methods of collection in the littoral area. In the shallower depths, up to three meters, the water of the lake was sufficiently transparent to permit accurate work. Beyond this collection was more difficult. To achieve a fair degree of accuracy a rake-net of 25 cm. width was drawn over a strip of lake bottom, sufficiently long to make a square meter. This method was employed primarily in depths exceeding 3 meters.

Investigations.—The main collections were made in spring, summer and fall of 1914 and 1915. During this time the littoral area of the lake was explored, both qualitatively and quantitatively; the aphytal area of the lake is now being studied from a quantitative standpoint.

The work soon resolved itself into a series of phases: (1) A qualitative survey of the macrofauna; (2) A quantitative survey of the commoner macrofauna; (3) Ecological distribution, and the criteria of lake life; (4) The breeding of unknown forms, and biological data on various species; (5) The actual use of insects as food by fish, and the reciprocal food relations of the fauna.

With respect to the qualitative survey of the macrofauna, it was the original plan to consider only the insect fauna, but it soon proved desirable to include the remaining macrofauna, if only as a basis for comparison, and the quantitative methods were extended to the other macrofauna, except fish. The lake was divided into 50 approximately equal divisions, or

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"stations", from which quantitative collections were made (fig. 1); over 350 quantitative hauls were obtained from depths of 0–7 meters from these stations. In addition over 400 qualitative catches were made from about 30 selected habitats in various parts and at various depths of the lake. Thus qualitative, quantitative, and ecological data were obtained.

Observations were made in the field and in the laboratory as to the criteria of life in Lake Mendota. To ascertain in what respects they differed from those of other bodies of water, collections from the following places were made:

Merrill Spring, Merrill Creek, Pheasant Branch Creek, Six-Mile Creek, Yahara River and Swamps, Yahara Spillway, Yahara Rapids, and Yahara Canal, Tenney Park Lagoon and Pond, University Brook, and Picnic Pond, all lying around Lake Mendota;

Lake Monona, its bays and outlet, the Yahara River;

Yahara Swamps and Lake Waubesa to the south;

Lake Wingra and its springs and pools to the north and south.

Each place was visited a number of times in different seasons. Over 1,500 additional collections, some of them quantitative, were made from these various bodies of water.

To the fourth phase, that of the breeding of unknown forms, only little time could be given. In general, the breeding was restricted to the species of Lake Mendota, known as well as unknown forms, the known ones for verification. Except for a beetle larva, all of the commoner species were reared successfully. A considerable number of species from other waters was reared thru some or all of the stages. The waters about Madison abound with little known aquatic species, and offer a fertile field to the investigator. Each pool, spring, swamp, and river contains its quota of species whose stages are unknown to science.

The fifth phase, namely the role of insects in fish food, has received considerable attention, thanks to an arrangement with Professor Pearse, who very kindly turned over to me the contents of fish stomachs examined by him. Over 1,700 fish stomachs, representing over 25 species of fish, have been examined and the insect contents specifically and numerically determined. In the study of reciprocal food relations probably several thousand insect stomachs (Chironomidae, Tri-

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choptera, Odonata, Ephemeridae, Coleoptera, Corethra, etc.) were examined; the food habits of the living insects were further observed in aquaria and in the field. This examination was extended also to leeches, Crustacea, Oligochaeta and other aquatic animals.

It is impossible to treat all of these phases together in a homogeneous manner. Even in restricted form, it is difficult to deal otherwise than in the most general terms with the several phases. For inclusion in the present paper the following topics have been selected:

I. Criteria of Lake Life,—that is, the lake as a physiological body, its ecological divisions, factors controlling the lake and its biota.

II. Qualitative and Quantitative Survey of the Macrofauna, its distribution, factors which decide the complex, biological notes and food relations.

III. Ecology of the Lake,—that is, the ecological habitats and their biota, food relations, and seasonal succession.

IV. General Comparisons,—with other hydrobiota and with other lakes.

PART I. CRITERIA OF LAKE LIFE

1. Lake Physiography

A. PHYSIOGRAPHY

Lake Mendota is the largest of a chain of four lakes in the Yahara Basin in the middle portion of southern Wisconsin. It is of glacial origin, lying near the southern edge of the drift. The lake is an irregular body of water (fig. 1), its greatest length being 9.5 km. (about 5.9 mi.), and its greatest width 7.4 km. (4.6 mi.). The circumference of the lake is 32.4 km. (21.9 mi.), its total surface area 39.4 sq. km. (15.2 sq. mi). Its greatest depth is 25.6 m. (84 ft.). The areas of the various depths are shown in table 1, page 471.

Shores.—A considerable portion of the shore line of Lake Mendota consists of cliffs of limestone with bold and rocky subaqueous terraces in front of them. Another large portion of the beach line consists of sand with an admixture of

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pebbles. The remainder, which constitutes about 60 per cent. of the total, is made up of gravel with an admixture of boulders of various sizes. The sand beaches are situated chiefly in the bays while the rock beaches are found at the most exposed points.

Bottom.—The bottom of the lake in the littoral area usually consists of coarse material, such as sand, gravel, and boulders of various sizes; rarely it is made up of mud which is covered with a thin layer of sand as in University and Catfish bays. Some detached shoals possessing rugged bottoms are of some ecological interest also. A shell zone several meters wide marks the lower limit of wave action. This zone is found at a depth varying from 4 meters in less exposed areas, such as University Bay, to 7 or 8 meters on the steeper shores; at Pic nic Point, probably the most exposed point on the lake, it lies at a depth of 14 meters. Usually the substratum preceding the shell zone contains a large percentage of marl, but in the zone proper shells constitute almost 90 per cent of the bottom deposit.

In general the bottom is nearly pure mud below 8 meters, but in the more exposed places a considerable admixture of sand may extend to a depth of 10 or more meters.

Sources of water.—Lake Mendota receives its water supply through several creeks and the Yahara River and from a number of springs. Some of the springs are of fair size and of considerable local interest; they are situated chiefly at the west end of the lake.

B. ECOLOGICAL HABITATS.

The lake as a whole may be divided into three general regions,—the *littoral,* or phytal region; the *aphytal* region; and *pelagic* region. The bottom of the lake may be best classed as follows: The *littoral,* with its two subdivisions, the *eulittoral* (euphytal), and the *sublittoral* (dysphytal); and the *aphytal* area. (See table 1).

a. The Littoral Region.

In Lake Mendota the ecological, physiological, and physiographical features are to a great extent parallel. The plant zone, the littoral area, and the zone of photosynthesis are ap-

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proximately identical. Comparably, the aphytal area, and the zone of decomposition are identical.

The littoral area in Lake Mendota extends to a depth of about 7 meters. Usually, the littoral area is accepted as the region of plant growth. In the present paper, the littoral area is regarded as composed of two major divisions, the *eulittoral* and *sublittoral*. The eulittoral area is the region of photosynthesis,—hence the region of plant growth. Below this lies a region of variable extent, a region of heaping refuse, a place where a minimal amount of photosynthesis may take place, but which is characterized by the absence of spermatophytes among plants; this is the sublittoral area. Parallel to the nomenclature of pelagic waters into euphotal, dysphotal, and aphotal regions, these two divisions may be termed euphytal, and dysphytal.

In Lake Mendota the eulittoral area extends only to a depth of 5 or 6 meters. This is rather surprising in comparison with some other lakes, such as the alpine lakes of Europe, where vegetation may extend to a depth of 25 and more meters. Lake Mendota presents the conservative extreme in this respect. As an example of the other extreme, Ekman (1915) reports green Characeae from a depth of 50 and more meters in Lake Vaettern, in Sweden, hence from a depth greater than twice the maximum depth of Lake Mendota.

The eulittoral area has three well-defined regions, or zones: shore line, rachion (breaker line), and plant zone.

Rachion (Breaker Line).—The rachion marks the point where the interaction of waves and returning undertow is greatest. In Lake Mendota this is at a depth of about 1 meter. The rachion may be continuous with the shore line (on steep grades) or entirely disconnected (shoals). In the latter places it is frequently divided into an "inner" and "outer" bar, a few meters apart from each other, and often many meters distant from the shore proper. In its physical aspects the rachion resembles the stony and gravel shores.

Shore Line.—The shore proper offers three varieties of habitats: (a) the rock beaches, characterized by shattered rocks and large boulders, which are not easily dislodged by waves; (b) the gravel (stony) beaches, composed of pebbles and stones, with an admixture of sand, the latter having the effect of smoothing the available surfaces; and (c) sand beaches,

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made up of sand and of finer pebbles. Physically, bars are continuous with shores, are subject to the same conditions, and are therefore included under that head. The shore is devoid of vegetation, except the plumes of the alga Cladophora on rock and gravel.

Plant Zone.—The plant zone in Lake Mendota extends from the breaker line to a depth of hardly more than 6 meters, as a whole not exceeding 5 meters. The upper delimitation is the rachion in the steep parts of the littoral area, but it is rather less marked in the shoals; yet even there the shore proper and the breaker line are always barren, and the vegetation between rachion and beach is comparatively scant.

In many lakes there exists a definite plant zonation. There may be a succession of areas characterized by the dominance of some plant, e. g., Lemna, Chara, Myriophyllum, etc. In Lake Mendota there is but one spot, where such a zonation is at all indicated. This is a small area along the western end of the bar in University Bay. Here a zone of pure Chara is followed by submerged hummocks of Lemna, this in turn by Myriophyllum and Ceratophyllum, and finally by Potamogeton amplifolium. Small areas may be found in other portions of the lake where some plant species may attain a slight dominance, as Chara does opposite Merrill Springs; but a true zonation is entirely absent.

There is, however, a secondary zonation, not so much of plant species, as of types of plants. This consists of a zone of "upright" or standing vegetation, e. g., Potamogeton amplifolium, Najas, and Vallisneria, which tend to reach the surface (but do *not* emerge); and a zone of "recumbent" vegetation, composed of Chara, Myriophyllum, Ceratophyllum, and some Potamogeton species, all of which tend to recline.

As incidental, but of direct ecological importance, the heavy incrustation of carbonates on the leaves of Potamogeton and Vallisneria should be noted. After some days of quiet weather the leaves of these plants are covered with a layer of lime, which breaks off in heavy weather and is swept to the bottom. In places the bottom is covered with a very appreciable deposit of this "plant marl." It forms a type of bottom which is little frequented by animals.

Shell Zone.—The lower limit of wave action is marked by the shell zone. In Lake Mendota this also marks the lower limit

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of plant distribution. As an ecological habitat it is fairly distinctive and has its own association. The zone is identical with the sublittoral area of more transparent lakes.

b. The Aphytal Region

The aphytal area is the area below the shell zone and includes the depths below eight meters. (I have used the word *aphytal* = plantless, in preference to "abyssal" which is used by Forel and others to designate the area below the plant zone; the latter word has been used in oceanography in a very special sense, and is therefore inapplicable and somewhat confusing when applied to limnology. Strictly applied, a shallow body of water, such as turbid ponds or streams, would then have an abyssal,—i. e., plantless, area).

The aphytal area presents the greatest uniformity of conditions and comparatively low ranges of variation. Its main features are the presence of mud and debris, the latter largely of organic and coprogenic origin. Because of the difficulty of making exact quantitative collections this area has been studied only qualitatively; but quantitative collections are now being made.

c. The Pelagic Region

This is the open water and the distinctive abode of the plankton organisms. In a quantitative study of the macroscopic fauna this region affects only Corethra among insects and Limnesia histrionica among Hydrachnida. Yet both of these forms are more or less concerned with substrata and will be taken up from that view-point.

C. HABITAT DISTRIBUTION

In general, the habitats in the lake are fairly evenly distributed. Uniformity of conditions makes for uniformity of response. Yet it continually happens that we find a different fauna in places which appear to be alike as regards external conditions. Quite a number of species are locally abundant in the lake, forming socalled "distribution islands." This localization of species is sometimes very difficult to account for.

It is also worthy of note that the seasonal distribution and

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the seasonal representation are not identical. According to the stage of life history a species may attain a periodic abundance,—generally during the warmer months of the year. Again, owing to the peculiar conditions of winter,—that is, ice on the shore line, and a more equal distribution of gas in the aphytal area,—the horizontal distribution of the species frequenting these regions will vary from that of other periods of the year.

Seasonal representation or seasonal succession of dominant faunal types is apparent to the collector. More will be said of this later, but it is desirable to call attention to the fact that in a quantitative study the seasonal element plays a very important part. To cite an instance, the collections made during late June and July show a remarkable scarcity of the case-building Trichoptera; yet collections made a month later will show them as the dominant faunal type of the plant zone. The same is true of Platyhelmia, of Annelida in general, of Hydra, Ephemerida, etc. This feature has had to receive attention in averaging the quantitative results.

2. Lake Physiology

A. Extrinsic factors

Molar Agents.—Under this term are grouped eroding agents, such as winds, waves, currents. Waves are the result of surface disturbances caused by winds. The size of the wave is proportional to the wind pressure on the surface, and to the distance traveled, less so to the velocity of the wind. On Lake Mendota the largest waves do not exceed 1.5 meters in height and may reach a length of 15 m. in storms.

The daily winds are an important feature of lake physiology. These light winds are frequent, occurring at various times during the day, even during summer calms, and may persist for brief periods. They may be of varying intensity, frequently covering the lake with choppy, crested waves of 7–8 meters length and half a meter's height.

In their effect on the lake physiognomy the waves are of primary importance. On the sandy shores there is a constantly moving film of sand. Rock and gravel shores are clean-swept, and the floating rubbish pulverized. On gravel shores pebbles and stones are torn loose and form a movable substratum with

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the sand which serves to smooth the shore. The rachion resembles the gravel shore with its fluctuating rubble. It is composed of smooth stones and marks the point where the interaction of waves and undertow is most violent. In shoals the rachion is entirely detached from the shore proper, sometimes a hundred or more meters distant. Furthermore, in such shoals there are "secondary" breaker lines found toward the shore, usually a short distance behind the first. The two rachia are comparable to the "outer" and "inner" bars of the ocean shore.

The lower limit of wave action is marked by the shell zone. Sand and other heavier particles carried by the waves are soon deposited, while the lighter shell fragments are carried farther down the slope to the limit of wave action. In Lake Mendota this lies immediately below the plant zone.

Winds and waves dominate the complex and the upper distribution of the littoral fauna and flora. Wave action determines the floral complex in that it banishes all emergent and floating vegetation from the lake proper (by "floating," plankton flora is not meant); it controls the upper distribution in that it banishes all plants from the shore area and the rachion, except the filamentous alga Cladophora.

Among the fauna the determining influence of molar agents is equally potent. Wave action controls the complex in that it banishes all surface breathers (with a few exceptions); it limits the distribution of water-breathers in that it permits only clingers and burrowers on the shore and in the rachion.

Waves furthermore aid the circulation of the lake, and thru the roiling of the bottom affect the clearness of the water, and hence the penetration of light for photosynthesis.

Temperature and Circulation.—In early spring after the ice goes out the water absorbs heat; thru the influence of the wind and convection currents the water is set into complete circulation so that the heat is distributed thruout the entire depth of the lake. As the days grow warmer, the surface water absorbs heat faster than can be communicated to the lower depths of the lake. There is a concomitant change in the quantity of the dissolved gases. This difference in dissolved gas and circulation increases as the summer progresses, and a zonation is established in the lake: (a) an upper, well oxygenated, warm layer, the *epilimnion,* comparable to a zone of photosynthesis;

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(b) a thermocline, or *mesolimnion,* a zone of rapid decline in temperature and in oxygen content; and (c) the *hypolimnion,* a bottom layer, which is poor in oxygen, cool, and constitutes a zone of stagnation and decomposition.

As an essential of life the distribution of oxygen exerts a decisive influence on the distribution of plants and animals. Despite the fact that bottom areas of the lake are without oxygen and exceedingly rich in carbon dioxide for several months of the year, a fair number of species lives in the decomposition area thruout the year; all of the species are present in large numbers.

Light and Mineral Matter.—The relation of these two is not a direct one, but may become so. The depth to which light may penetrate water depends on the clearness of the water. Particles of solid matter in suspension control its clearness and hence its penetrability. This is well illustrated by a comparison of Lake Mendota and some of the alpine lakes. Lake Mendota contains a large amount of matter in suspension; a white Secchi's disk of 15 cm. diameter can be seen at a depth of about 2.5 m. in the open lake, and about 3 meters near the shore. In some of the alpine lakes a similar disk can be seen at 10 and more meters. Ekman (1915) reports 18 meters as the limit of vision in Lake Vaettern.

The degree of penetrability affects the photosynthesis of plants. Aquatic plants receive a more ideal light for photosynthesis than those on land. That is, the best light for photosynthesis is a diffuse or dispersed light of about the intensity of bright moonlight, or one twelfth of sunlight. Such a diffuse condition prevails in the water. The light is dispersed by the particles; much of the light is reflected by the surface so that the intensity is somewhat lessened. This intensity decreases with the depth, and we actually find an increase in growth as depth increases, up to an optimum point, until we finally come to the minimum where light is too insufficient for photosynthetic activity. That is to say, plant growth is more luxuriant as the depth increases, and the optimum is not found at the surface, but some distance below; in Lake Mendota this optimum lies between 3–5 meters.

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B. INTRINSIC FACTORS

Respiration.—Aquatic animals can be conveniently divided into surface-breathers and water breathers. The latter obtain their oxygen directly from the water. Surface-breathers, however, must come to the surface for the replenishment of their oxygen supply. Many surface breathers attach themselves to the free surface film by means of hydrofuge bristles, plates, and rosettes, and bring their stigmatal opening into contact with the atmospheric air; others cling to some object in the water, usually a plant, while they push their breathing apparatus above the water. In the first case a *quiet* surface film is essential, in the second an *emergent* vegetation,—two conditions which do not exist in the lake for a continuous period.

The outstanding feature of lake physiology is the constant commotion of the surface. Periods of perfect quiet are exceedingly rare; for even on the calmest days of summer light breezes disturb the surface for short periods. The fairly constant wave-action does not permit the growth of an emergent vegetation,—the second essential. The two conditions, quiet surface film and emergent vegetation, necessary to the surface breather, are absent from the lake—hence an absence of sur face-breathers from the faunal complex.

There are a number of insects which would seem to form exceptions to the rule, i. e., some aquatic beetles and Hemiptera. Certain of the beetles, however, have readapted themselves and have become water-breathers (not in a direct sense) again, as will be explained elsewhere. Other forms will readily seize oxygen bubbles secreted by plants instead of going to the surface,—an ingenious method of replenishment which is practiced also by hibernating surface-breathers under the ice.

In the lake, this method of bubble capture applies to most beetles and some of the Hemiptera. Some of the latter, however, regularly swim to the shore during a blow; as do most beetles during prolonged blows, altho they are able to stand prolonged submersion.

Locomotion.—A second characteristic of the lake habitat is that the animals are either clingers directly, or indirectly so thru artificial aids, such as burrows, tubes, webs, and other fastenings. Free swimmers except fish and plankton organisms, are rare indeed. Corethra and the Ceratopogoninae are the

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only ones among insect larvae, and Corethra is confined to deep water while the others seek shelter in algae (Cladophora, Spirogyra, Batrachospermum, etc.).

Food Supply.—Nutrition is of less influence on the lake complex than on the distribution within the lake. Phytophaga among animals are restricted entirely to the zone of photosynthesis,—while secondarily sarcophaga are restricted in their distribution by the same factor. To escape such limitations, some species have become necrophagous and coprophagous, and may occur wherever organic waste is present.

Currents.—It is essential to consider the relative strength of currents and their frequency in discussing the lake complex. Many water-breathers are restricted to waters which have a *continuous* flow, such as rapids and falls; these species are homoiophilous. In the lake the habitat which most nearly approximates this condition is the rock shore, and the gravel beach and rachion to a lesser extent, where intermittent takes the place of continuous wave action. Hence it is not surprising that many of the inhabitants of the rock beaches are found also in the rapids.

This statement must not be made too categorically, however, for the condition of the bottom may perhaps be a more decisive factor than the current. In the case of the inhabitants of the rock beaches it may be the presence of rough surfaces, especially rocks, that is really the determining feature. For instance, Psephenus lecontei, certain may-flies, and other petrophilous species are found on the stones of rock beaches and in the Yahara Rapids. If current were the decisive factor, then they ought also to be found in the short rapids of Merrill Springs and Merrill Creek; yet they are absent from these places.

Special Habits.—Certain special habits seem to influence the lake complex. This is notably the case among Trichoptera, Ephemeridae, and Odonata. Several species of caddisflies are confined to the springs along the lake shore, never occurring in the lake proper. The same is true of some Ephemeridae. The dominance of a habit, however, is best illustrated in the case of Odonata; here the habit of oviposition is, I believe, decisive. Most Zygoptera, Aeschninae, and some Corduliinae oviposit in plants,—therefore a habit necessitating the presence of emergent vegetation which is of course absent

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from the lake. Enemies, behavior, and other factors may influence the complex and distribution of the fauna, but usually in combination with one of the major factors already discussed.

PART II. QUANTITATIVE AND QUALITATIVE SURVEY OF MACROFAUNA

In the following pages I have not attempted to give the details of the quantitative work. In all of the tables I have merely noted the final averages. Thus, if a species occurred in 20 out of 50 catches, the latter number was used to average it, and from this the total has been computed. In a number of instances, however, the total average was so obviously inconsistent with the actual representation, that the totals had to be revised and raised or lowered arbitrarily, according to the findings of the qualitative catches. This was especially the case with the Hydroptilid caddisflies. These occur in the lake for a very short period. But since it was impossible to visit all of the stations during the time of their maximum, the final averaged total was proportionately much too low. Hence a lower number was used as a basis for average for these and some other species. In general, however, the averaging was strictly adhered to.

The Macroflora of Lake Mendota

Because of their importance as a substratum and as a food supply, it seems advisable to give a list of the larger plants in the lake. I am indebted to Professor Denniston for the use of certain tables showing the distribution of the plants in Lake Mendota. The following is a list of the species taken:

1. From Shore line and Rachion.

Cladophora glomerata L.

2. From Plant Zone. True lake species which are quite general in their distribution. All are submerged plants.

Potamogeton pectinatus L.
" zosteraefolius Schum.
" richardsonii Bennett.
" lucens L.
" alpinus Balbis (a rarer species).
" amplifolius Tuckerm.

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Najas flexilis Rost. & Schmidt.
Vallisneria spiralis L.
Ceratophyllum demersum L.
Myriophyllum verticillatum L.
Chara crispa L.

3. Swamp, pond and river species which may be found locally, in places where the lake tends to swamp, and also opposite the mouth of rivers and creeks. Largely emersed species.

Lemna minor L.
Lemna trisulca L.
Scirpus lacustris L.
Castalia odorata Wood & Wood.
Utricularia vulgaris, var. americana Gray.
Typha latifolia L.
Radicula nasturtium-aquaticum L.
Ranunculus delphinifolius Torr.
Nymphaea advena Soland.
Philotria canadensis Britt.
Wolffiia columbiana. Karst.
Zizania aquatica L.

The Macrofauna

I. invertebrate phyla (excl. arrthropoda)

1. Porifera.

Spongilla fragilis Leidy.

Only the encrusting form of this sponge occurs in the lake, on the rocks of Maple Bluff, Governors Island, and Picnic Point, and in parts of the Yahara Spillway.

2. Coelenterata.

Hydra fusca Linne.

No numerical data of this species are given. It is ubiquitous in the littoral area of the lake, and locally may be found in enormous quantities. A Myriophyllum plant with seven branches totalling a length of four meters was found to hold over 15,000 specimens. In late fall the sexual individuals are especially abundant. Hydra may hibernate, but in quite reduced numbers. Probably the greatest representation of Hydra may be found along the channel of the Yahara River to

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the north, where it passes thru the swamps; that region seems to present optimal conditions for Hydra.

A few specimens of Hydra viridis Linne were taken on Chara at the mouth of Merrill Spring in August, 1914. This rare species has been obtained elsewhere only from spring-fed pools north of Lake Wingra.

3. Bryozoa.

Plumatella repens Linne.

Like Spongilla, this species encrusts the under side of rocks along rocky shores and in the Yahara Spillway. Some distance up the Yahara River I have found palmate growths of Plumatella on the underside of lily-pads; such growths are infrequent in the lake on plants, altho they may be occasional on Potamogeton amplifolium. More minute growths of Bryozoa, belonging to the genus Fredericella, and probably also to Lophopus, occur plentifully on the plants of the lake, and frequently on the bottom to a depth of eight meters.

4. Platyhelminthes. (Table 5, p. 474.)

Planaria maculata Leidy.

This ubiquitous species is found practically everywhere in the lake. The color variations are considerable and one may be tempted to consider the extremes of specific distinction. It is possible, indeed probable, that several species have been lumped as P. maculata in the numerical estimates. A relative, P. doritocephala, is abundant in Merrill Spring; another species, P. agilis, is frequent in the springs and occasional in the lake.

Polycelis nigra Ehrenberg.
Dendrocoelium lacteum (Müller).

These two species, so interesting because of their colors, apparently find conditions optimal in Merrill Spring, where they are thick on the stones in the channel. Both species are occasional in the lake, confined apparently to the rocky areas.

Mesostoma ehrenbergii (Focke).

This form was taken in four of about 350 catches. It is very common in Picnic Pond in May and June, but disappears as

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the temperature of the water rises. Its transparency makes it difficult to see and it is probable that it has been overlooked in some of the collections from the lake, where it was found in late July and August. Like its relatives it travels on slime-trails, but when irritated will go thru a violent flapping motion free in the water,—in fact, an actual swimming reflex resembling the vertical wave-motion of some leeches.

5. Nemathelminthes. (Table 5, p. 474.)

Gordius aquaticus Linne.
"Pink" Nematode.

During late June large numbers of young Gordii and of some other, "pink" Nematode may be found coiled on plants or on the bottom of the lake. Most of these occur in the shallower parts, but they are also quite frequent at greater depths. Apparently they have just left their intermediate hosts to search for others. Many are of course destroyed during this "free" period, which lasts not more than two weeks, while others succeed in finding a second host.

Especially Chironomus tentans larvae and pupae are found to be infested with Gordius, some containing as many as three individuals. Other Chironomid species may also be infested with them, notably the larger species C. lobiferus, tentans var?, and plumosus; I have not found the worms in the smaller species, nor in any other lake insects, (they probably occur in Ephemeridae) altho I have repeatedly observed the unsuccessful attempts of Gordius to enter caddis-worms.

The "pink Nematode" may be a form of Mermis; I have found it in Chironomus palliatus, lobiferus, and viridis. No mature specimens were obtained. Gordius adults are not uncommon in the lake and especially its tributaries and basins in September.

6. Chaetopoda. (Table 5, p. 474.)

Only the larger Annelids have been considered individually in the numerical counts. Except for Sparganophilus eiseni Smith, which is a purely littoral form, the data given cannot be considered complete, for they apply only to the littoral area, while at least the Lumbriculids are quite general in their distribution.

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A distinction must be made for the small Oligochaeta which are given in bulk. They form a very conspicuous percentage of the numerical total of the August fauna, altho less prominent as regards their bulk. As a rule they live in loosely constructed cases of accretions and secretions on the aquatic plants, and were it not for the difficulty of gathering them and freeing them from their cases, an individual count might be attempted. They are not difficult to recognize, for each of the several species of Chaetogaster, Nais, Pristina, etc., which make up their membership, has a distinctive locomotion, usually of the S-type, which makes identification of living specimens comparatively simple. Fish eat a large number of them, but it is difficult to estimate the percentage, for only the minute setae remain undigested.

Of the bottom Oligochaeta, Limnodrilus claparedeianus Ratzel, Tubifex tubifex Müller, Lumbriculus limosa, etc., are eaten with the mud by perch, suckers, and other fish. Sparganophilus eiseni Smith, the blue earthworm, is confined to gravelly areas and has been taken up to depths of 2.5 m.

7. Hirudinea. (Table 5, p. 474.)

The distribution of leeches in the lake was found to be more uniform and less restricted than at first suspected, except for Erpobdella punctata (Leidy) and Nephelopsis obscura Verrill. Altho the percentage of specimens is much larger in rocky areas a great many individuals are found among the plants of the littoral depths.

Erpobdella and Nephelopsis, curious to say, find their optimal conditions on the shore margin, where coarse gravel and stones are intermixed. Stones buried at the point where water and shore meet seem their favorite habitat choice; for under these rocks, of about a size of 25 by 15 cm., one may occasionally find clusters of as many as 85 individuals on a single rock. The stones are often tightly wedged and the leeches evince surprising agility and strength in burrowing under them. The egg-cases of Erpobdella and other species are common on the stones of rock and gravel shores.

The food of leeches is variable, and may consist of the microfauna and flora of the lake as well as of some of the larger lake forms. Thus I have found may-fly larvae (Hexagenia,

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Caenis), and Trichoptera larvae (Polycentropus) in Erpobdella punctata, while other leeches contained Chironomid larvae, Hydrachnida, Hyalella, etc. On several occasions I found small leeches of the genus Glossiphonia attached to the under side of the beetle larva Psephenus lecontei; whether the leech was feeding or whether it was a mere accidental relation I am unable to say.

8. Mollusca. (Table 5, p. 474.)

Not all of the species occurring in the lake have been listed in table 5. For some reason Lamellibranchia are comparatively little represented (if one excepts the enormous numbers of the minute Corneocyclas which occur in the aphytal area.) Amnicola limosa Say is by far the most abundant of Gastropoda. In early summer its favorite spot seems to be the rachion (breaker line) where at a depth of two meters it covers the stones in immense numbers.

The general distribution of the Gastropoda in the littoral area is fairly uniform. Certain species evince a preference for the bottom,—at least I have rarely found them elsewhere; while others are quite common on plants, busily feeding on the Oligochaeta and Chironomids. In the aphytal area I have not found any Mollusca except Corneocyclas; very rarely one may meet a specimen of Limnaea stagnalis. This is rather surprising because of the fact that in so many of the European lakes, especially the deep alpine lakes, many Gastropoda have become permanently aphytal. (Forel, Roszkowski, Zschokke).

II. ARTHROPODA.

1. Crustacea. (Table 5, p. 474.)

Dikerogammarus fasciatus (Smith).

This Amphipod is confined to the rocky and stony shores of the lake. A relative, Gammarus limnaeus, is very abundant in the slack water of the springs and creeks at the western end of the lake, and also in the Yahara Spillway.

Hyalella azteca (Sauss).

As will be seen from table 5, this species is of comparatively wide distribution in the littoral area. Yet despite the formid-

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able numbers found, the optimum conditions appear to be those of the Yahara River, entering the lake on the north. In the lateral parts of the stream, where it shallows over the mud of the swamps but still retains a fair current, Ceratophyllum and Myriophyllum are very abundant and line the channel with thick waving mats. These "mats" form the feeding and breeding ground of Hyalella; among the leaves and stems of the two plant species they live in such tremendous quantities that the plants appear gray from the living encrustation. On an area approximating a square meter with a depth of one-half meter I collected between seven and ten thousand Hyalellae one August day.

Hyalella is avidly eaten by fish, insect larvae of various kinds (Odonata, Gyrinus, Dytiscidae, Hydrophilus), and also by leeches. On their own part they eat diatoms, and other microfauna and microflora, and will not spurn eggs of Hydrachnids, damselflies, Trichoptera, and other insects. In aquaria I have repeatedly seen them gnawing Chironomid pupae, even when other food was plentiful,—on several occasions resulting in the death of some cherished specimen which I was attempting to breed.

Cambarus propinquus Girard.

This is the commoner of the two species of crayfishes listed. Young specimens form an item of the spring food of fishes. They are not at all uncommon in the stony and gravelly portions of the shore. There they may be found wedged under stones, with smaller pebbles heaped around them,—a type of incipient burrow. In the less exposed depths they are not so cautious and seek only the slight shelter of plant leaves. C. virilis Hagen, another species, seems to be restricted to the deeper portions of the lake, where Prof. Pearse has secured it in gill nets.

Asellus communis Say.

I have only a single record of this isopod in the lake, and this, I believe, was an accidental occurrence after a freshet which carried much of the Merrill Creek fauna from its original location. Its absence from all lake catches is rather peculiar, for it has been reported from European lakes. It is very comonm in the slack water of Merrill Creek and the Yahara Spillway.

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2. Hydrachnida. (Table 5, p. 474.)

The great bulk, I may say 99%, of the Hydrachnid contingent of the lake is composed of members of the Hygrobatidae. The commonest of all forms is Limnesia histrionica (Hermann), which occurs as practically the sole representative of the subfamily. Other common forms are Curvipes turgidus Wolcott, Atax ypsilophorus (Bonz), etc. The genus Arrhenurus especially offers a large field, for quite a number of species have been taken, several of them apparently new to science.

Except for an occasional Arrhenurus, Limnesia histrionica forms the chief Hydrachnid contingent of fish food. However, on a number of occasions I have found Eylais and Hygrobates present, especially in creek fishes. It is of interest that altho the red Hydrachnida and their scarlet eggs are shunned by fish, insects, and other Hydrachnida, they—the red ones—appear to enjoy their own eggs as food. They also will readily attack other Hydrachnida, but usually not the red species.

In general, the Hydrachnid food consists of their own kind, of Chironomid larvae, and of other animals whose pellicle they can pierce. All of the nymphs, most of the larvae, and a few of the adult mites are parasites. The symbiotic relation with sponges suggested by some writers is probably inapplicable; the sponge merely offers transient shelter, for mites will hide as readily in empty shells, in larval cases, and in egg clusters (Odonata, Trichoptera, Gastropoda, etc.).

Of all groups present in the lake their distribution seems most uniform. Respiration seems a slight factor with them; most of them have lost their tracheae entirely and breathe through their skin. Their free swimming habit makes them independent of a substratum except as a source of food, while their small size permits easy access to shelter.

III. INSECTA.

A. Order Plecoptera.

At least three species of stone-flies occur in Lake Mendota. Each of these appears to be fairly abundant, the adults appearing in April, June, and July, respectively. Yet for some reason unknown at present, I have failed to find any evi-

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dence of the larvae, or of the exuviae at the time of emergence, notwithstanding very careful search.

B. Order Ephemeroidea. (Table 5, p. 475.)

All may-flies are water-breathers during their larval existence. They seem, for the larger part, to be stenoedaphic,—that is, with a small range of substrata. The lake species are for the larger part petrophilous, a few species are essentially phytophilous.

Specimens representing various species of the genus Baetisca, Baetis, Callibaetis, Siphlurus, and Ephemerella are occasional in the lake, but occur so sparingly that they have not been considered in the quantitative estimates.

Caenis diminuta Walker.

This is a small species, very abundant and quite general in its distribution. It is phytophilous and quite uniformly distributed in the littoral area. Like most other may-flies of the lake, it emerges in early June. It is common in fish food.

Ecdyurus maculipennis Walsh.
Heptagenia canadensis Walker, H. interpunctata Say.

The three species named form a conspicuous part of the rock community of the lake. Their depressed form, as well as their strong claws, makes them particularly adapted to turbulent waters. H. canadensis in Lake Mendota has been found chiefly in depths exceeding two meters, hence beyond the influence of the greatest wave action. This indicates that the condition of the substratum and not the current is the controlling habitat factor for this species. All three are true petrophils of the infra-petral type (i. e., found on the underside of rocks).

The food consists of micro-organisms, Hyalella, some Hydrachnids, and occasionally one of their kind.

Ephemera varia Eaton.

This species in its general habitus recalls Sialis, with which it appears to divide the distribution area. That is, Ephemera is a littoral form, and Sialis begins its distribution at the shell zone, where the other leaves off. Ephemera varia is a bur-

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rower, and its fore-legs show a distinct spatulation for the purpose of burrowing in sand and gravel. It is worthy of interest that there is a change in habitat with the growth of the larvae. Young larvae frequent the sandy bottoms at depths exceeding one meter, hence are distinctly ammophilous (sand-loving); I have no records of young larvae from rocky areas or from any part of the shore line. Older larvae, however, are found chiefly in rocky and stony areas, especially on the shore line,—hence are petrophilous.

The situation amounts practically to this: the adults appear during the first days of June, young larvae will be found several weeks later in the deeper sandy bottoms, while at the same time an occasional full grown larva may be found in the rocky regions of the shore line; after the middle of August older larvae will be very common on gravel and rocky shores, and exceedingly rare on sandy bottoms, especially those below the rachion. A second flight of adults occurs in early August; that is, the specimens which failed to emerge in June emerge in August.

C. Order Odonata. (Table 5, p. 475.)

From the standpoint of adaptation to *amphibious* life the Odonata as a unit have reached the highest development among insects. Amphibious existence is ancestral with them, and they have equipped themselves for both terrestrial and aquatic life during their larval state. For aquatic respiration they have the rectal gills (Anisoptera) or caudal gills (Zygoptera), while both suborders possess open thoracic spiracles for aerial respiration. The latter are impermeable to both water and miscible oils (Portier 1911) so that an exchange from an aquatic to an aerial medium, and vice versa, can be effected immediately.

In spite of their perfect adaptation to any type of aquatic life the Odonata are very sparsely represented in the lake complex. I believe that this is due to the ovipositional habits of the adults. Odonata lay their eggs on a free substratum or in plants. It is of course obvious that in the second case the eggs must be laid in plants which emerge from the water. Hence we find this type of species restricted more or less to habitats showing emergent vegetation; this includes most Zy-

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goptera, Aeschninae, and many Cordulinae. But even those species which lay their eggs free on a substratum (sand, matted algae, scums, etc.) or in the open water are largely confined to the more quiet habitats. This may be due to the food varieties, more of which are offered in ponds, swamps, and quiet streams, than in turbulent waters. However, it is important to point out that it is not the respiratory factor which restricts the Odonate lake complex, but purely that of food and a special habit, oviposition.

Habitat relations, general form, and method of locomotion are closely interrelated in the Odonata. This relationship is expressed in table 2. Both positions at rest and methods of locomotion are combined in order properly to designate the main types of larvae. Many genera or subfamilies are comparatively restricted; thus, the Zygoptera in general, and also Gomphinae and Petalurinae, are poor swimmers, and have primarily a sedentary, "clinging" mode of life, and the Gomphinae and Petalurinae a burrowing habitus. (See p. 471.)

Argia putrida (Hagen).

The nymph of this species is easily recognized from its stout, depressed form; it is slate-colored, with white-tipped caudal gills. It belongs to the category of rock-clingers and is one of the characteristic forms of turbulent waters. While it occurs in the rocky areas of the lake, its optimal habitat seems to be in rapids.

Enallagma antennatum (Say).

This species is fairly abundant in the lake, together with Ischnura verticalis. It is a true plant clinger. Other species of Enallagma occur in restricted areas of the lake, especially where a river fauna enters or a swamp fauna lies nearby. In such spots Enallagma hageni, carunculatum, ebrium, signatum, and pollutum may be found in fair numbers. No Lestinae occur in the lake, but they are abundant in spring-fed ponds and in clear creeks.

Gomphus fraternus (Say).

The nymph burrows into the sand or rubble at the point where wave-action is strongest, hence at the breaker-line. Like Argia putrida, it is much more abundant in rapids than in the lake.

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Epicordulia princeps (Hagen).

In parts of the lake, especially opposite rocky shores, the larvae of this form are not at all scarce. During July one may see the exuviae clinging to the face of the cliff for a height of 10 meters, while the spotted adults are busily engaged hunting for prey or ovipositing. The eggs are laid in long strings, usually at the surface on the floral beds of Potamogeton and other plants.

D. Order Hemiptera. (Table 5, p. 475).

Hemiptera are not conspicuous in the lake community. Few of them are hardy enough to withstand the severities of lake conditions. Two species of Corixa, one of Notonecta and of Pelocoris, and the ubiquitous Plea striola form the Hemipteran contingent of the lake; and for the first three it must be noted that they are abundant only in the tiny nooks one may find along the shore line, where the immediate shore forms an accessible shelter during adverse conditions.

Experiments have shown that Corixa cannot endure any prolonged submersion in disturbed water, two hours being the maximum; Notonecta is a little more hardy, while the minute Plea is hardiest of all, enduring a submergence of five hours without much damage. That the true habitat of all five of these species is not the lake, is indicated by the fact that in flowing streams, and especially in the swamps of the Yahara River, the same species of Corixa, Notonecta, and Pelocoris are enormously abundant, at least three times as abundant as in the most favored spots of the lake. Fish caught in such regions will be found gorged with specimens of one or all species. Belostoma, Nepa, and Ranatra are entirely absent from the lake. They are adapted to an emergent or floating vegetation and hence do not occur in the lake. Only the fact that Notonecta, Corixa, etc. may rapidly change from an aquatic medium to the shore permits them to stay in the lake, but then always within a short distance of the shore, as indicated by the quantitative hauls.

E. Order Neuroptera.

Sysira umbrata Needham.

This is the only spongilla fly I found in the lake. At Maple Bluff it is occasional in the encrusting sponges. No numerical

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estimates have been made, as it forms a negligible item. Various species of Hemerobius occur in the sponges of other waters, but I have not found the larvae.

F. Order Megaloptera.

Corydalis cornuta Linne.

I have on several occasions taken larvae behind the bar of University Bay, but never in the lake proper. It is not an abundant species.

Sialis infumata Newman. (Table 5, p. 475.)

The larvae of this species constitute one of the major items of insect fish food. Late in April, or in early May, during a very brief period, the larvae migrate to the shore, emerging there in immense numbers to pupate in the earth. After two weeks the adults emerge; they may be so abundant in places along the shore as to be an annoyance to the pedestrian or boatman frequenting the spot. In oviposition the females lay their eggs in thick, velvety masses on the branches of trees, on sticks, and on piers along the water's edge.

In emerging the larvae drop into the water, where fish are attracted in numbers, apparently relishing the feast. The larvae immediately migrate through the plant zone to the sub-littoral area, where they are very abundant. On the bottom they will wander downward as far as the oxygen content of the water will permit them to go. As the oxygen goes out with the warming up of the lake, they migrate to the shallower regions; vice versa, they go downward with the fall overturn.

Perch brought up from the deepest portions of the lake in winter were found to contain many of these larvae.

A two-year cycle is indicated by the fact that shortly after the annual shore migration half-grown larvae are quite abundant in the lake. I secured them freely with the dredge throughout the summer.

The larvae live chiefly upon organic detritus of various origin. They do not refuse live Chironomids and worms, however. They are water-breathers and may descend to any depth, controlled by the oxygen supply.

The numbers quoted are incomplete, since they do not account for the distribution below 6 meters, altho the maximum is found below the depth indicated.

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G. Order Hymenoptera.

Several parasites have been caught or bred from insects obtained from the lake. With the exception of Diapria columbana Ashmead (kindly determined by Prof. C. T. Brues) they still await identification.

As an extraneous source of food supply the Hymenoptera are not without some importance in the lake economy. The variable winds of the summer blow thousands of insects of all sorts into the lake, where they become water-trapped and drown, or may be directly eaten by fish. As regards drowning I estimated in the summer of 1914 that 2 % of the bulk of insects collected was formed by dead insects,—most of them Hymenoptera. At the time of their summer flights millions of winged ants are blown into the lake and become the toll of the water and of the fish. That the latter will eat ants greedily, is attested by the gorged stomachs of perch and other fish which were filled with Camponotus, and Formica. Other forms which are very common in the lake toll but rarer in fish stomachs are Pelecinus polyturetur, Apis mellifica, various species of Bombus, Polistes, Vespa, Bembex, Ammophila, Pompilus, Ichneumon, etc.

The important fact, however, is that the fish should eat ants in such quantities whenever available, since this brings up the question of nauseous emanations, similar to those by which the Hemiptera are supposedly protected.

H. Order Lepidoptera.

Two species of Lepidoptera have been taken in the lake. Nymphula maculalis larvae were secured in different parts of the lake in various depths. But the optimal situation seems to be the sheltered portion of University Bay, at the point where the bar joins the Picnic Point peninsula. There the larvae of N. maculalis and N. allionalis occur in large numbers on Potamogeton and Vallisneria. In Picnic Pond close by Hydrocampa sp. is also abundant.

As an item of fish food the Lepidoptera are negligible.

I. Order Trichoptera (Table 5, p. 475

During the latter half of summer and early fall the Trichoptera form the greater bulk of the littoral fauna of Lake Men-

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dota. One species, Leptocella uwarowii, is especially common, occuring in amazing numbers. Each haul of a square meter contains a fair number of individuals, often as many as 85 to 100 (over 500 in two instances).

In their general ecology the caddis-worms are more uniform than any other group of aquatic insects. In food habits they are primarily phytophagous; all of them live in shelters of some sort,—from those formed by a loose accumulation of refuse to the most elaborately constructed webs and cases; all are water-breathers and are supplied with lateral gill-filaments or anal blood-gills for respiration.

Family Hydroptilidae.

Agraylea multipunctata Curtis; Hydroptila sp.; Ithytrichia clavata Morton; Orthotrichia sp.; Oxyethira sp.

These five species of Hydroptilidae occur in Lake Mendota, the first three quite commonly; the last two rarely. In June and early July when all other caddis-worms have pupated, they are in their larval stage and form one of the characteristic seasonal complexes of the lake.

Agraylea, Hydroptila, and Ithytrichia are very abundant in the rocky areas of the lake among the Cladophora, while the first may be more or less generally found on the filamentous algae which cover the bottom and vegetation of the littoral area to more than three meters' depth.

Agraylea is distinctive because of the bean-shaped green case, woven from parallel algal filaments; Hydroptila has a case of similar shape, but made up of extremely fine sand granules; while Ithytrichia makes a case of clear green secretion, bottle-shaped, with the wider end open. The other two species, Oxyethira and Orthotrichia, have cases which are shaped as a poppy seed, or like a flat flask, respectively. In pupation the caddis-worm usually merely closes the open end of the cases, making sure beforehand that the case is firmly attached to a rock or plant. Ithytrichia, however, forms a pupal case of two tapering ends which resembles a leech cocoon remarkably, fastening the two ends each with two bands to the under side of rocks.

In places the various species may be quite abundant. On an Elodea plant of about three meters stem length, including all

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branches, I counted over 1,500 specimens of Agraylea multipunctata. As an item of fish food they are negligible, not because of their inavailability but because of the difficulty of capture.

The adults are often taken for Microlepidoptera. I have bred four of the species listed, two of them in quantities. A peculiarity noticed for Ithytrichia and Agraylea is that the pupae may swim about in the water for quite a while before ecdysis. The adults of both of these species have also been observed to swim actively.

Family Hydropsychidae.

Polycentropus sp.

The species is restricted to the rocky shores and the breaker line, altho on several occasions specimens have been taken some distance out on plants. The web spun by the larva is a funnel with fluted ends, the whole covered by a woven sheet.

Its relative, Hydropsyche alternans Vorhies, is very abundant in the rapids of the Yahara Spillway, where it constructs a loose network into which it anchors some of the flotsam sweeping over the falls.

Family Molannidae.

Molanna uniophila Vorhies.

The larva is an inch long, and builds a tubular case with lateral extensions. The larva lives on sandy bottoms and despite its "obvious" adaptations to strong molar agents is much more common in depths below the breaker line than above.

Family Leptoceridae.

Leptocerus ancylus Vorhies.

The larva is small, half an inch or less in length, and builds a case consisting of a tube imbedded in a concave shield. This species is confined to the rocky shores where it is found on the under side of the rocks.

Leptocerus sp.

This species which was bred from material obtained from the shell zone proved to be different from known American species, and may be identical with the European L. fulvus. Its case

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is of sand and shell fragments. The species seems confined to the sublittoral area.

Leptocerus dilutus Hagen.

The minute, curved, and hooded cases are characteristic for the rock and gravel shores, though less common on the latter. This is not an abundant species.

Leptocella uwarowii Kolenati.

This is the characteristic caddis-fly of the lake, especially in the plant zone, and occurs everywhere in amazing numbers. It is adapted to a variety of aquatic conditions, for it seems also to be able to maintain itself to a fair extent on the rocky shores and in the rapids of the Yahara Spillway.

Only the larger fish eat the caddis-worms, for the long cylindrical tubes are somewhat difficult to manage. In fall, at the time of the heavy equinoctial storms, myriads are swept onto the shores and killed in the surf. After such a storm a thick lake drift lines the shore, while a secondary drift may be found in places in the water; a large portion of the accumulation will be composed of the dead Leptocellae.

Setodes grandis Banks.

Though occurring sporadically in the lake, the true habitat of this species is the Yahara River north of the lake. There the larvae in their translucent green cases may be found abundantly on Myriophyllum, etc.

Triaenodes flavescens Banks.

The spiral case is characteristic for this species. It is fairly abundant in somewhat sheltered spots, such as the small bayou north of the Yahara Spillway.

Family Sericostomatidae.

Helicopsyche borealis Hagen.

This is a small species, which is quite common on sandy bottoms. The characteristic case is built like that of a snail, as which it has been repeatedly described. First instar larvae build a slightly twisted case, while that of the second instar larva is like the case of the older stages. The species is eaten frequently by fish.

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Family Limnephilidae

Limnephilus sp.

I attempted to breed this species, but overlooked the final ecdysis until too late. The case is square like that of Limnephilus rhombicus Linne, and composed of fine bits of crossed twigs, fibers, etc. This species, however, is much smaller than its relative of the springs.

The larva is the only active "swimmer" among the lake caddis-worms, most of which are too heavily encumbered by their cases to be able to swim at all (except the first and second instar larvae of caddis-worms which are all good swimmers.) The species is not infrequent in the lake.

Platyphylax subfasciatus Say.

This is the largest species found in the lake, although rare. In places it may be abundant, at a depth of about a meter. Its congener, P. designatus Walker, and relative, Neophylax autumnus Vorhies, are quite thick in the waters of Merrill Spring.

Family Phryganeidae.

Phryganea interrupta Say.

A single specimen of this species was taken in the lake, in a sheltered part of University Bay. Like Neuronia postica Walker, it is more characteristic of smaller streams and ponds, and is not uncommon in Pheasant Branch Creek. Here it lives among the roots of the plants or buried in the fine silt of the bottom.

J. Order Diptera

The Diptera have adapted themselves to a greater variety of conditions than any other order of insects. These conditions range from aerial and terrestrial to subterranean and aquatic, from ectoparasitic to endoparasitic. On a taxonomic basis none of these conditions can be stated as characteristic exclusively of the different groups of the order. For instance, all transitions from a damp habitat to a semiaquatic and holaquatic habitat may be found. These transitions take place within close relationships, and the facility with which members of a single family pass from one extreme to another is extraordinary, and de-

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notes great plasticity. The attempt to select the aquatic representatives of the Diptera for inclusion in the present study proves this strikingly. Table 3 is a compilation intended to show the degree of "aquativeness" of the larvae—that is, the extent to which larvae have adapted themselves to an aquatic mode of life. This is evidenced most strongly in the respiratory adaptations,—whether the larvae have remained surface-breathers (i. e., come to the surface to breathe the air above it), or whether they have become water-breathers (i. e., obtaining their oxygen directly from the water.) (See p. 472.)

It is surprising to find that seven of the families are only in part aquatic; again, it is interesting to note that several families have members under the extremes of terrestrial and water-breathing habits (Leptidae, Ceratopogoninae); or, that of a partial and a total aquativeness as in the Psychodidae, Corethridae, and Anthomyiidae.

On the one hand, this classification indicates that the transition from a purely terrestrial habitat to an aquatic one is not very difficult; it also indicates that the final step from surface-breathing to complete water-breathing is, after all, not so very great. On the other hand, the presence of water-breathers alone in the lake complex demonstrates the dominating influence of respiration; while a further specialization of the aquatic habit is found in the limitation of some species to a *constant* current.

In the present paper only two of the Dipterous families can be considered, the Corethridae and the Chironomidae.

Family Corethridae. (Table 5, p. 475).

A single species of this family occurs in the lake, Corethra punctipennis Say. The Corethridae are of interest in more ways than one. In the first place, the presence of semiaquatic and holaquatic larvae distinguishes the family. Secondly, the fact that Corethra is one of the few insect genera whose species are pelagic is of considerable interest. In addition the peculiar anatomy of the larva, its remarkable transparency, its physiology, and its importance as an item of fish food make it noteworthy.

Corethra punctipennis occurs in the lake in enormous numbers. Due to its pelagic habits, it is possible to give only an approximate estimate of its numbers. The figures given in the

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table are littoral catches made at pupation periods and of no value in estimating the deeper distribution. (Some of the catches made in the summer of 1916 by means of a clam-shell dredge show numbers ranging from 2,000 to 18,000 individuals per square meter.)

Corethra begins to pupate about June 10th and enormous swarms emerge continually during the summer weeks of June 15th to about August 20th; the numbers then decrease to September 10th, when they become small, the last adults emerging about September 30th. Corethra emerges at night, beginning early in the evening and continuing through the night. Large swarms of them fly to the lights of Madison or gather in the tree-tops, especially in the vicinity of the lake. In the morning, if the lake is quiet, the females can be seen resting on the surface, ovipositing through the surface film.

From observations made since 1912, it seems that there are about six great periods of swarming or emergence, alternating with an equal number of minor "pulsations." In each case the adults live about three to five days.

The larvae, while primarily pelagic, hunt their food chiefly at the bottom, where they nestle into the soft ooze. The food consists of small worms, and the various components of the plankton. In Picnic Pond, where specimens of Corethra are quite abundant, I have watched them feed on Volvox. The method of feeding is curious. Bits of food are rasped off the prey, taken into the stomach, and digested. After digestion the waste is ejected through the mouth (Frankenberg 1915), an observation which can be easily verified.

Transparency is the greatest protection of the larva and pupa. Despite this tranparency Corethra is eaten in large numbers by the fish of the lake, especially by the bottom feeders of the deeper waters. One frequently finds specimens of perch which have gorged themselves on Corethra larvae.

Corethra is unique in its system of respiration. At each end of the body are found two twisted air-chambers, which are entirely detached from the surface. Their structure is tracheal, and they function primarily as static organs, and possibly as storage organs for oxygen used in respiration. The general tracheation is very meager and appears insufficient. In respiration the oxygen must be taken from the water through the skin and carried in the blood wherever needed. In contrast

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to the larva the pupa has an elaborate tracheation which communicates with a pair of external air-chambers from the thorax.

Pupal life is very short, and lasts one to three days, at most.

The daily migration of the larvae needs mention. In daylight the larvae are found below the thermocline and in the bottom mud, while at night they come to the surface. Aside from the considerable adjustment entailed by the change in pressure (at least two atmospheres), there is the change from aerobic to anaerobic conditions which perplexes us and leaves us in doubt as to the precise status of the air chambers.

The larval history lasts about six to seven weeks. Hence there may be three generations during the summer, the wintered larvae pupating in May and June, the second generation appearing in late July and early August, the third generation in September. Wintering larvae are uniformly larger before pupation than are summer larvae.

Family Chironomidae. (Table 5, p. 475).

The species of Chironomidae about Madison are legion. The various waters,—lakes, ponds, springs, creeks, swamps, whichever they be—all contribute their share to the Chironomid complex. Only a small portion of this complex has been studied, and a still smaller portion only can be referred to in this paper. In practically all of the species listed it was possible to breed the species and verify previous work. Additional species from other waters were also bred, some in all of their stages, some in part only,—wherever opportunity offered and time would permit. An idea of the richness of the Chironomid fauna may be gained from the fact that I have taken at least 35 species from the lake, and that each of the surrounding waters contains several other species. The contents of fish stomachs from various localities have apprised me of further unknown stages.

Ceratopogoninae.

Palpomyia longipennis Loew; Probezzia pallida Malloch; Probezzia glaber Coquillet.

Specimens of these three species were bred in large quantities. All three are common in the lake and appear to show a special preference for Cladophora and other filamentous algae as a habitat.

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The larvae of Palpomyia longipennis and Probezzia pallida resemble each other in form, but differ greatly in size; both are white, and have a vibratile method of locomotion,—like that of a rod which is fastened at one end and permitted to vibrate freely at the other. Probezzia glaber is pale green, and extremely attenuated; it swims in regular, worm-like undulations.

For emergence the pupa of P. longipennis climbs up the sides of rocks and rubbish, while the other two species emerge from the water surface. Parallel to this is the ability of the Probezzia species to rest on the surface-film and oviposit through it, while Palpomyia breaks thru the film and must therefore oviposit from solid objects.

These larvae have an interesting method of letisimulation. When grasped while in the water they straighten out and become rigid; this is one of the few cases where aquatic insects feign death in their normal environment. Since their color resembles that of the filamentous algae among which they live, the larvae may be said to be doubly protected. In spite of this, they are quite frequent in fish stomachs. They are quite resistant to digestion, specimens having been taken alive from perch stomachs several hours after capture of the fish.

The Ceratopogoninae are among the free-swimming insect larvae although not pelagic. They do not build tubes or shelters such as the Tanypinae and Chironominae. Their range appears to be limited by the oxygen distribution of the lake; in winter, like the fish, they go to deeper waters, but with the advance of the thermocline they migrate toward-shore. For respiration they evert retractile gills from the anal opening.

They pupate in July, and during June and early July form the chief Chironomid contingent of the littoral catches. Three other species of Ceratopogoninae have been found in Lake Mendota, but I have been unable to breed them; they are not abundant. According to the sex, the larvae show a dimorphism in size, the female larvae being uniformly larger than the males.

Tanypinae.

The habitus of the Tanypinae is more Chironomid-like. The larvae resemble those of the true Chironomids, while the pupae bear a strong resemblance to the Corethra type. In many

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forms the head of the larva is elongate, and the antennae are frequently retractile. The following forms have been found in the lake.

Protenthes choreus Meigen.

The distribution of this species is practically identical with that of Chironomus tentans in the lake. It is fairly abundant in the bottom mud and forms an important item of fish food.

Tanypus decoloratus Malloch; Tanypus monilis Linne; Tanypus carneus Fabricius.

These three species occur in the lake, but only T. monilis in appreciable numbers. All three are littoral forms. The larva of T. monilis is remarkable for its retrogressive locomotion, resembling that of a crayfish. None of the species build true cases, but live free or in concretions which are loosely put together.

Chironominae.

This subfamily comprises the true "blood-worms," although this designation is somewhat of a misnomer. Most of the species are able to spin tubes, using plant fibers or sand granules.

Chironomus abbreviatus Kieffer.

This is species number 82 of Johannsen (1905). The species is littoral and sublittoral in its distribution.

Chironomus tentans Fabricius.

This is the largest of all Chironomid species that occur in the lake. Its distribution is practically confined to the bottom area of the lake, although it occurs in great numbers in the muddy areas behind the bars of University and Catfish bays. It is stenoedaphic in mud, hence limophilous. Larvae have been taken from the lake, ponds, creeks, in fact wherever a mud bottom occurs.

The larvae are extensively parasitized by Gordius, at times by as many as three individuals, although usually only a single parasite is present in the larva or pupa. The species transforms during late April and May and late September and October. There is a peculiar parallelism between transformation and the amount of available oxygen, transformation de-

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creasing in early summer as the oxygen goes out, and increasing with the increase of the oxygen content of the hypolimnion in early fall.

A dimorphism in size of the larvae, which was at first supposed to indicate a two-year cycle, was later found to be a sexual difference, the larger larvae being females. Female larvae may attain a size of 5 cm., while males rarely exceed 3-3.5 cm.

This species forms a very conspicuous item of fish food, especially during the winter.

In connection with this species it seems appropriate to test out Miall's dictum, "that only such Chironomus larvae as live at the bottom and burrow in the mud possess the red hemoglobin. Those which live at or near the surface have colorless blood." As far as Chironomus tentans is concerned, the red color is characteristic of the larva no matter where it occurs,—in the bottom of the lake, pond, or horse-trough. Conversely, Protenthes choreus with which it is associated in the lake, shows only occasionally a slight suffusion of pink, no matter where it may be found; usually the larvae are of a cream or pale green color, with the fat body showing through the epidermis.

In general, I have found so much variation as to the color of the larvae of the various species in identical surroundings that it is obvious that no fixed rule can be laid down as to coloration. There is no intensification of color parallel with the increase in depth, such as Miall suggested. I have taken red specimens of C. lobiferus, digitatus, fulviventris, etc., from depths varying from 0.2 to 6 m.; while pale specimens of the same species were found at precisely the same depths (see discussion of color varieties under C. lobiferus). In fact, at any given spot on the shore one may find specimens of these species colored a brilliant scarlet, while at a depth of one meter or five meters the same species may be pale, or vice versa. What I wish to emphasize is the absolute lack of any correlation of intensification of color and of oxygen supply. Needham (1903) called attention to the fact that the young of the red species when hatched from the egg are pale, never red.

Chironomus digitatus Malloch; Chironomus fulviventris Johannsen; Chironomus lobiferus Say.

These three species are littoral forms of wide distribution. C. digitatus is of special interest in that it is sand loving form

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(ammophilous), and is common on sand beaches and in the finer gravel. C. fulviventris is somewhat similar in its predilections, but more isolated in its distribution. C. lobiferus is quite regular in its distributon, and is a ubiquist as regards its habitats,—varying from sand, gravel, and rocks, to plants and filamentous algae.

The larvae of the three species are trimorphic as to color. The larva of C. lobiferus may be a bright red, a very pale green, or reddish transfused with green. In C. fulviventris bright red larvae occur, others that are pale cream, olive green, or red with a transfusion of green. Even more marked are the distinctions of C. digitatus in which a scarlet larva is commonest, white or pale green next frequent, and a rarer form is colored a dark red with green parenthetical dorsal markings on each segment. I have tried to discover a racial character in these markings, but the breedings of all three types for C. digitatus and C. lobiferus proved their identity.

A peculiar feature is that in C. digitatus and lobiferus the variations occur side by side, so that one may find red and green forms of either species in the same locality. In C. fulviventris I have found the red forms only in the short rapids of Merril Spring and in the sandy parts of the lake shore; the pale cream form seems to be confined to the outlet of University Brook into University Bay.

The food of these three species has been examined in several hundred specimens. Diatoms, Protozoa, algal spores, and in several instances smaller Chironomid larvae, were found in the stomachs. On two occasions larvae of Hydrachnida were found in C. lobiferus; these probably belonged to Limnesia histrionica, for those of other species are less common and generally protected by armor or secretions. In turn, the larvae are eaten by fish; C. digitatus notably forms the food of shore fishes, especially of the darters, and Cottus. I have seen smaller larvae frequently attacked by Hydrachnids, while the crustacean Hyalella azteca at times has the annoying habit of nibbling at the respiratory tufts of the pupae (field and laboratory observation).

Chironomus plumosus Linne; Chironomus tentans var.

Both species are confined to the littoral area. C. plumosus in Lake Mendota is restricted to a few places on the north

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shore, while C. tentans var. is more general in its distribution. It is of interest that the Giant Midge, C. plumosus, so common in the muddy depths of Lake Winnebago, should be confined purely to a few rocky and gravelly areas in Lake Mendota,—one of the peculiar contradictions so frequently met with in limnological studies. C. tentans seems to begin its distribution in the lake where C. tentans var. leaves off. That is, it is confined to sandy areas and gravel while C. tentans seems to be restricted to mud bottoms.

Chironomus viridis Macquard; Chironomus pallidus Coquillet.

The former species and its congener, C. palliatus, the latter the rarer of the two, were first called to my attention by their appearance in fish food. C. viridis emerges early in the year and was not met with in 1914. In 1915 I did not find it till August when it was quite common on plants in depths of one or more meters.

Chironomus modestus Say; Chironomus flavus Johannsen.

The two species are not abundant. C. modestus is ammophilous, while C. flavus frequents plants.

Tanytarsus exiguus Johannsen.

This is the only species of Tanytarsus found in more than one locality in the lake. In each case I found it at depths exceeding 5 meters, where the larvae would be fairly common.

It is characteristic of the species of the genus Tanytarsus that they are more or less localized in their distribution. I have taken T. agraylioides (= obediens Joh.?), lauterborni, muticus, bausei?, dives, etc., in the lake, but always confined to a single locality, so that they cannot be considered in a quantitative study. The habits of the larvae of this genus are specially interesting; many of them build cases which are remarkable for their form and variety.

Cricotopus trifasciatus Panzer; Cricotopus exilis Johannsen.

Of the two species C. trifasciatus is especially abundant. It is a shore form, nearly ubiquitous in its habitats, and is much eaten by fishes. It is a common species in creeks and swamps.

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K. Order Coleoptera. (Table 5, p. 475).

Adaptation to an *aquatic* mode of life has reached its greatest differentiation among the aquatic Coleoptera. Table 4 aims to show the progressive adaptations for the families listed. It is difficult to class the Coleoptera into surface-breathers and water-breathers. For on the one hand some of the adult Coleoptera are able to effect a gaseous interchange while submerged; on the other hand some of the water-breathing larvae have stigmata which they are able to use at the surface, although in the latter case primarily in the prepupal stage. In effect, therefore, the adults mentioned (some Dytiscidae, etc.) are true water-breathers, yet in a manner different from that of the larvae. (See p. 473).

Again, many regular surface-breathers are intermittently submerged, for a long period during the winter, and are able to effect a partial oxygenation during their submersion (Wesenberg-Lund, Ege, etc.). This complicates the situation and allowance must be made in a table. The adaptations to the aquatic environment are so manifold among both larvae and adults, that it seems as if each species has developed individual means and methods of aquatic respiration. Among the list of families noted as breathing "submerged air" there is hardly one which follows precisely the same method as any of the others.

Now, with all their manifold adaptations to an aquatic life, aquatic beetles, except for a few species, are scarce in the lake complex. Surface-breathing larvae are entirely absent from the lake; water-breathing larvae, while common to a certain extent, are limited through their adults, which usually are surface-breathers. Beetles, in one or all stages, are surface-breathers; and it is through the surface-breathing habit that the molar agents exert their dominating influence on the lake complex.

The Hygrobiidae, Dysticidae, Hydrophilidae (except Berosus), Donaciinae, and Gyrinidae, the latter despite the water-breathing larvae, are practically absent form the lake community. The typical lake Coleoptera are the Haliplidae in the vegetation zone, and the Dryopidae in the rocky and gravelly areas, while several species of adult Dytiscidae are locally abundant.

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Family Dytiscidae.

In the earlier part of summer, late May to the middle of July, adults of Bidessus flavicollis Leconte, Coptotomus interrogatus Fabricius, Hydroporus undulatus Say, and Laccophilus maculosus Say, are not at all uncommon in the lake. Individuals of Agabus and Colymbetes may occur, but rarely. Since adjoining ponds, creeks, swamps, and basins are on the whole copiously provided with larvae of Laccophilus, Acilius, Cybister, Agabus, etc., although entirely absent from the lake, it is probable that such adults as are found in the lake have migrated into it and have not bred there. In specially favored spots where shelter permits some emergent plants to gain a foothold one may find some Dytiscid larvae.

The difference between the lake and other aquatic communities is very marked in late summer, when sheltered water such as the lagoons in the parks and the several ponds and creeks about the lakes teem with young Dytiscid larvae of several species, while such larvae are conspicuously absent from the lake. As a food factor the Dytiscidae are therefore negligible so far as the lake is concerned; but this does not apply to creeks and rivers.

Family Hydrophilidae.

Only a single species, Berosus sp. (probably striatus Say), is represented in the lake, and this species is quite rare. The larva occurs in sandy depths up to six meters. I was able to breed the species and discovered that the pupa is aquatic and a water-breather like the larva; but the emerged adult escaped before I had seen it. In the fast current just below the Yahara spillway, the species seems to thrive; at least, fish taken at the spot frequently contained larvae of Berosus.

Family Gyrinidae.

The larvae of the Gyrinidae, like Berosus, seem to find conditions optimal in the current below the Yahara spillway. In that stream, too, the adults are exceedingly abundant, occurring in enormous swarms composed of many thousands of individuals. Although an adult Gyrinid is occasional in the lake, no larvae have as yet been found.

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In fish taken from the Yahara Canal Gyrinus larvae are rare, while adults, in spite of their presumably noxious emanations, are more frequent.

Family Haliplidae.

Haliplus ruficollis DeGeer; Peltodytes edentulus LeConte; Peltodytes duodecimpunctatus Say.

These three species are common in the lake, both in larval and adult form (except the larva of the last, which I have not found). The larvae are water-breathers, while the adults can remain submerged for considerable periods. The larvae are microphagous on filamentous algae and are not restricted in their distribution save by that of their sheltering plants. In creeks, basins, and elsewhere the larvae may be quite abundant. Among the Cladophora and other algae just below the Yahara spillway, Haliplus ruficollis larvae are especially abundant and form a favorite item in the food of fish.

Family Dryopidae.

There is no other insect family with aquatic representatives that offers as many points of interest as the Dryopidae. Adaptation to an aquatic life has reached its highest development among them, both in the larvae and in the adults. As will be seen from table 4 there are two groups according to degree of aquativeness, both of which have in common holaquatic larvae and terrestrial pupae, but differ in the aquatic habits of the adults. (See p. 473).

Of the five genera given, Limnius is not represented in the American fauna, its place being taken by Stenelmis. Psephenus lecontei and Stenelmis crenatus were bred in large quantities, while a third species (a larva resembling that of Elmis somewhat and which I believe is Dryops lithophilus) did not reach pupation in the various cultures.

Stenelmis crenatus Say; Elmis vittatus Mels.

The larvae of Stenelmis crenatus resemble those of the European Limnius troglodytes. In color they range from a light brown to a deep black, and it was thought at first that two species were represented in the larval material. Extensive breeding proved the identity with Stenelmis crenatus.

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The larvae are water-breathers, extruding an anal tracheal tuft for the purpose. In general they live in tiny burrows made in gravel or in sand between stones, but they may frequently be found crawling freely over rocks in depths from the shore-line to 6 meters. Besides crawling, the larvae have a quite unusual method of swimming; this is retro-progressive (i. e., moving backward), but in an inverted position, the recurved caudal segments flapping violently. For pupation the larvae leave the water and in the moist sand make a pea-shaped burrow in which they transform. Pupation begins in the middle of August and lasts for about 10 days. The adults immediately reenter the water, where they copulate and deposit their eggs on rocks.

In a sense, the adults are true water-breathers. For they remain submerged continually, rarely, if ever, coming to the surface for the replenishment of their oxygen supply. Brocher (1912) in a very interesting paper has shown that Stenelmis adults exchange oxygen very readily through the abdominal plastron of air.

In Lake Mendota Stenelmis adults occur chiefly in plant marl, gravel, and sandy bottoms in depths up to 10 meters.

I have not found a single larva nor adult in any of the eight hundred or more shore fishes examined.

Dryops lithophilus Germar; Parnid sp. larva.

I do not know the larva of Dryops lithophilus, but suspect that it is the Elmis-like, or "trilobitic" larva found fairly abundantly on rocky shores, and here referred to as Parnid sp. I have failed to breed this larva hitherto although I assembled them in considerable quantities. The optimal habitat of the larva is between one-half and one meter depth on rocky shores, apparently where wave action is quite strong. It also occurs among the rocks of the Yahara spillway.

Dryops lithophilus frequents the moist places of the shore and may occasionally descend into the water.

Psephenus lecontei Leconte.

The characteristic larva of this species is the famous "water-penny" or "stone-penny" of the rocky shore. The larvae occur in depths of 0–6 m. and seem to be restricted to a rocky and stony habitat. They are always found on the under-side

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of stones. For respiration they have branched abdominal gills, which, however, unlike the trilobitic Parnid sp. just mentioned, are not retractile (the other also possesses a retractile anal tuft of tracheae).

In late July the larvae emerge in enormous numbers from the lake and pupate in the moist soil under the rocks near the water margin. In 1915 pupation took place immediately before a rise of 17–20 cm. in the lake level, which resulted in the death of great numbers of the pupae, since the latter, like the adults, are terrestrial. If it were not for the fact that the year-old larvae remained in the lake—the species has a biennial cycle—the lake population of the form would be considerably diminished.

The adults are terrestrial. Copulation takes place on land. Oviposition may take place at the water's edge, on stones in the water, or the female may descend some distance into the water to lay her eggs.

Locally the larvae may be exceedingly abundant. On one occasion, in July, 1915, I found over 800 specimens in an area of one square meter at Farwell's Point. Yet curious to say, I have no records of their being eaten by fish. Whether this is due to their excellent protective adaptation or to some other factor remains to be seen; I have, however, on several occasions, found small leeches attached to the underside of the larvae.

A problem of distribution was revealed during some dredgings made on the shallow reefs in the eastern portion of the lake. Each of the reefs is over half a mile from the nearest shore, hence it is unlikely that larvae might migrate to them. But the dredge contents showed that the larvae were quite abundant on one of the reefs. Since the reefs are covered with at least 3 meters of water at their highest points, the assumption of drift as an explanation for the distributional "island" is out of the range of probability. How the larvae got there, how they pupate (pupae being terrestrial), etc., remains a riddle for the present.

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PART III. ECOLOGY OF THE LAKE.

I. ECOLOGICAL ZONATION.

The general ecological zonation has been discussed in part I of this paper. But for the sake of comparison the following summary of the vertical and horizontal sections of the lake is offered:

Area	Vertical Section	Depths	Horizontal Section
Littoral (Phytal) — Eulittoral (Euphytal)	1. Shore line (incl. bars)	0–1 m.	Rocky—barren Stony—barren Sandy—barren
	—Shoals	1–1 m.	Sandy—sparse veg.
	2. Surf line (Rachion)	1 m.	Stony—barren
	3. Vegetation Zone — Upright	1–5	Potamogeton, Najas, Vallisneria
	3. Vegetation Zone — Recumbent	4-6 m.	Chara, Myriophyllum, Ceratophyllium, Potamogeton.
	3. Vegetation Zone — Barrens	Patches	Plant, marl., sand, stones
	—Rock Reefs	3-8	Rock, with encrustation
Littoral (Phytal) — Sublittoral (Dysphytal)	4. Shell Zone	6-8	Shell, sand, mud-barren
Aphytal	5. Aphytal Zone	7-25	Mud, with admixture of detritus, (shell, ooze, etc. organic and coprogenic sediment)

Practically the entire macrofauna of the lake, except the fish, is bound to one or other substratum; fish, too, show certain habitat preferences conditioned through food, or through reproduction, which delimit their distribution. Since the physical agents operate on the substrata, it is through the latter that we must study the ecological habitat.

In a study such as the present it becomes necessary to make sweeping statements without considering possible, and more probable, exceptions in the way of habitat preferences and associations. These preferences are deduced largely from the quantitative averages. While a quantitative method tends toward exactness, it carries with it an element of uncertainty in that it necessarily restricts itself to the exploration of a very definitely circumscribed area; hence qualitative catches have been used to supplement the findings.

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DEPTH DISTRIBUTION.

Table 7 (p. 477) indicates the distribution of the species of the various groups in the order of their depth occurrence. The optimum depth has been noted in italics. Distinction should be made for species whose depth distribution extends below 7 meters. In many of these it means that they extend over the entire lake bottom beyond the depth of 7 meters; for others the distribution may be limited according to certain bottom conditions, and, more especially, by the gas content of the hypolimnion.

ECOLOGICAL DISTRIBUTION.

In its larger aspects the lake is divided into two areas, the littoral, and the aphytal area. The littoral area is assumed to extend from the shore margin to the lower limit of photosynthesis,—hence of plant growth. Below this is a region of comparative quiet, of relatively mild changes, of no plant growth—the aphytal region.

The littoral area permits of two subdivisions,—a eulittoral region, reaching from the shore margin to the lower limit of photosynthesis,—in Lake Mendota nearly synonymous with the limit of wave action; and a sublittoral region, a region of heaping of refuse and drift, lying next to the vegetation area, and synonymous in Lake Mendota with the lower limit of wave action.

In the following the ecological habitats of these areas are taken up in both their vertical and horizontal aspects. The littoral area in vertical section can be regarded as composed of (1) The shore line, (2) the breaker line, and (3) the plant zone,—comprising the eulittoral area; and (4) the shell zone—comprising the sublittoral area.

The Eulittoral (Euphytal) Area.

1. The Shore Line.

The physical characteristics of the shore line vary somewhat in the different parts of the lake. In this paper the shore line is distinguished as that narrow strip of lake border which owing to the exposure to molar agents has a "clean-washed" appear-

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ance. This strip is rarely more than nine meters wide, and in Lake Mendota is easily recognized, even where separated from the breaker line by extensive shoals.

Physiologically, it is a region of great molar activity, and, with its more or less shifting bottom, presents certain definite ecological aspects. The animal (or plant) that desires to live there must be able to meet (a) great molar action of wave and undertow, (b) a partly shifting bottom as a result of molar action, (c) extremes of temperature, and motion, (d) prolonged periods of hunger,—in general, sudden changes to which other parts of the lake, except the breaker line, are not subject.

In horizontal section, the shore line may be classified into rocky shores, stony or gravel shores, and sandy shores. The lake shallows will be treated as part of the vegetation area. Each of the shores is more or less distinct in its conditions and associations, and will be treated separately.

A. The Rocky Shores.—In Lake Mendota these occupy about a fifth of the lake circumference. The physical aspect is that of large boulders, shattered rocks,—in general an appearance of roughness. The width of the rock shore is usually from 8 to 10 meters, its depth often being continuous to 6 or more meters; for the purposes of ecological association the depth to 1 meter alone will be considered. The slope of the rock shore is usually considerable, and the surf line is practically always continuous with it, generally marking the lower edge.

In its physiological aspects the rock shore indicates the greatest exposure to molar agents found in the lake. The heavy waves, the surf, the strong undertow and its accompanying drift, the swift changes from quiet to turmoil, present conditions which relatively few animals are equipped to meet.

The only plant found is Cladophora, a filamentous alga, the plumes of which are conspicuous at all times of the year. An elaborate system of clinging rhizoids, and great pliancy of the plumes enable it to meet the conditions of wave action. Since it needs the sunlight for food manufacture it is never found on the underside of rocks.

The animals in turn, except the visitors, are practically confined to the underside of rocks (see table 8, p. 471). They must, therefore, not only meet the action of the general molar agents, but must protect themselves from the undertow and the shifting rubble. To meet wave action, the prime response is to

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offer as little resistance as possible. This means that the animals have a flattened body, or that they enclose themselves in flat structures, or that they apply appression methods. In addition, they must be supplied with strong clinging devices.

The mayfly nymphs Heptagenia interpunctata, Ecdyurus maculipennis, and Siphlurus alternatus, and the Odonate nymph Argia putrida offer good examples of depressed body structure. Depression in a secondary sense is attained by Psephenus lecontei and a Parnid larva in that the segments of the body are supplied with lateral extensions, which are very efficient in permitting the animals to appress themselves. Compression laterally is again the means by which the Amphipods Hyalella azteca, Dikerogammarus fasciatus, and Gammarus limnaeus adapt themselves; however, these belong to the category of migrants or visitors.

Caddis-flies form a characteristic element of the petrophilous fauna, but their submission to conditions is shown more in the structure of their protective cases than in their own morphology. Thus, the flat, Ancylus-like case of Leptocerus ancylus forms one of the finest instances of shore adaptation. Leptocerus dilutus usually seeks some tiny depression in a rock in which it anchors its curved, hooded cases. Similar in character to Leptocerus ancylus are the flat leech cocoons which are numerous under the shore rocks.

A number of petrophilous species meet the factors by other types of appressed structures. Thus the tubes of Chironomids, especially of Chironomus digitatus and C. lobiferus, are quite common on the underside of rocks, where they are invariably built of sand granules and firmly anchored by means of some secretion. A more marked instance is that of Polycentropus sp. which weaves a funnel-like tube and over this spreads a broad sheet of webbing. Appression, too, is the growth method of the stone sponges and bryozoans. All of these forms are equipped with strong clinging devices, in the way of claws, suckers, cementing substances, and minor adaptations.

During certain months of the year the fauna among the Cladophora plumes is quite abundant. It consists of the caddisworms Hydroptila sp., Ithytrichia clavata, and Agraylea multipunctata, and occasionally an Oxyethira sp., which feed on Cladophora. Chironomus lobiferus may frequently be found in cases built of algal filaments. Still more marked is the pres-

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ence of free-swimming Ceratopogoninae larvae of Palpomyia longipennis, and especially of Probezzia glaber and P. pallida. Yet except for Ithytrichia clavata none of these forms is truly petrophilous; they are to be regarded as primarily algophil, since they are found on filamentous algae in the lake wherever these occur. In the shore area they may occur on the under as well as the upper side of rocks and stones.

Some burrowers are frequently found on the rocky shores. These are Stenelmis crenatus larvae and the older larvae of Ephemera varia. Here also may be found Cambarus propinquus, which wedges itself under stones and heaps gravel about itself. All three are more common on gravel shores.

Among vertebrates Cottus and Etheostoma flabellare are characteristic of the rock beaches. These and the Crustaceans Hyalella, Dikerogammarus, and Gammarus can be called migrants or visitors, for most of them migrate in unfavorable weather. Other visitors are the Hemiptera and adult Coleoptera. These very readily climb the rocks and leave the water during unpropitious conditions.

A secondary zonation is indicated. While most of the species on the list are primarily petrophilous, they seem to prefer certain regions of the shore. Thus, at the immediate shore margin one may invariably find hundreds of leeches that have burrowed under the rocks at a depth of about 10–15 cm. below the surface. Most of the petrophilous fauna prefers the middle ground between the shore margin and the lower edge which marks the breaker line. This is illustrated in the case of Psephenus lecontei and its relative, Parnid sp.; Psephenus prefers the upper middle ground, while the Parnid may be found more abundanly toward the breaker line.

Owing to the peculiar conditions of this shore area, and especially because of the lack of vegetation except Cladophora, the food conditions are necessarily somewhat uniform. Alimentation is possible only during relatively short periods. Since even then many of the forms do not wish to leave their shelter under the rocks, they must feed on the micro-organisms found in their immediate vicinity. This means a mixed diet. Several species, however, such as Polycentropus sp., Hyalella, and the Ephemerid larvae, quickly mount to the upper side and feed on the Cladophora or on the very abundant microfauna and flora which breeds among the algal filaments.

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Before passing on, note must be made as to the extent of the fauna of the rock shore. Vertically, the fauna extends downward below the breaker line, often for several meters. Thus, Psephenus lecontei, Ephemera varia, Heptagenia, Ecdyurus, Stenelmis crenatus, Chironomus digitatus, C. lobiferus, etc., are found not only occasionally, but in fact quite frequently on rock bottoms at depths exceeding two, three, and even six meters. This is an important phenomenon. These same species are also found under the rocks of milder rapids, in creeks, rivers, and falls. If we note in addition that several of the species have been found on the rocky reefs in the middle of the lake, it must be evident at once, that current can hardly be considered the primary factor in the distribution of these forms; that on the contrary it is probably the condition of the substratum,—namely the rock bottom,—which is the determining factor, and that current and the ability to respire under difficult conditions are secondary factors.

B. The Cobble (Gravel) Shores.—Cobble shores occupy over one half of the shore lines of Lake Mendota (inclusive of bars). Their physical character is that of stones of varying size intermixed with gravel and coarse sand, all worn to *smoothness* by molar agents. Hence they are analogous in their conditions to those offered by the rock shores, and the difference is a relative one, expressed mainly by the facts that there are fewer and smaller and also smoother rocks, that there is an abundance of pebbles and of coarse sand,—in general, that there are fewer clinging surfaces.

Physiologically, the same conditions hold true as for the rocky shores. Yet the finer composition of the substratum permits a comparably greater activity of the molar agents upon it; in heavy weather there is a steady oscillation of sand and gravel carried by waves and undertow. And this fluctuation of the rubble may be said to accentuate the need of protective shelter for this association.

Thus, soft-bodied animals,—such as Planarians, various Oligochaeta, Ceratopogonine larvae, the larvae of may-flies,—and adult bettles are much rarer in the stony association than among the rocks. However, it is necessary to distinguish between absence due to molar agents and absence due to food supply. The alga Cladophora, so conspicuous on the rocky shores, is found in more isolated patches; like soft-bodied Planaria, it cannot

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withstand the grinding wear of the rubble. But since it is the sole food supply of the phytophagous petrophils it is obvious that these will not be found where no suitable food supply exists. Thus the caddis-worms of the rocky shores are for the greater part absent, or at least much rarer among cobble-stones,—due primarily to the absence of their food-plant.

In a measure, this absence of caddis-worms may be due also to the lack of sufficient protection; for while their cases are built strongly enough to withstand the impact of waves and spray, most of them would fare only indifferently well in the gravelly areas. As a matter of fact, the majority are absent, except Leptocerus ancylus, an occasional Leptocerus dilutus, and the Hydroptilids Agraylea, Ithytrichia, and Hydroptila, which live on Cladophora. But all of these are proportionately much less frequent, even among their food-plants, than in the rocky areas. The scantier representation of the may-flies,—that is, of Heptagenia, Ecdyurus, Baetisca, and Caenis, is probably due directly to the undertow and its drift,—for these larvae have no further shelter beyond their chitinous covering. Hyalella, and the irregular component of beetles and Hemiptera are all more scattered.

The characteristic of the cobble and gravel fauna is, therefore, that its representation of *clinging* forms is much smaller than that of the rocky areas. On the other hand, the number of burrowing species is much greater. In fact, burrowers may be said to dominate,—for the moving sands and gravel are much more favorable to their existence in tubes and burrows than to the exposed clingers. Thus, Sparganophilus eiseni, the "blue earthworm," is practically confined to the pebbly shores, while burrowers and tube-builders like Stenelmis, Gomphus fraternus, Ephemera varia, Argia putrida, Chironomus digitatus, C. lobiferus, C. modestus, C. plumosus, C. tentans, Cambarus propinquus, Erpobdella punctata, and Nephelopsis obscura find the gravel shores apparently optimal,—for nearly all of these are much more frequent here than anywhere else in the lake. It is especially true of Chironomus digitatus, C. tentans var?, and C. plumosus, and of Stenelmis crenatus larvae, Sparganophilus eiseni, Cambarus propinquus, and Ephemera varia. Erpobdella punctata and Nephelopsis obscura, as on the rocky shore, here also burrow at the shore margin, some 10–15 cm. below the surface, under flat stones.

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C. Sandy Shores.—The transition from gravel shores to sandy shores is nearly imperceptible and is marked primarily by the gradual diminution in the number of larger pebbles and rocks. The absence of the latter means that no clinging surfaces whatsoever are left,—hence also a total absence of any larger plants. Secondly, the sand as a substratum is still more influenced by molar agents, and forms an exceedingly insecure bottom,—in fact, it lacks permanence entirely.

Hence the fauna must cope with, (a) a bottom which is only transient, (b) the absence of clinging surfaces, (c) a bottom which shifts with the slightest disturbance, and (d) a resultant absence of plant food.

Yet it is surprising that even here some species manage to maintain themselves. Thus, I have found Sparganophilus eiseni and a Lumbriculid burrowing in the sand; Chironomus digitatus, one of our commonest forms, appears to have a predilection for sandy and gravelly bottoms, and builds its tubes copiously along the sandy shores; C. modestus, C. tentans var?, and C. fulviventris imitate C. digitatus in this respect. Hyalella azteca is quite frequent as a visitor; and the Johnny Darter, Boleosoma nigrum (Rafinesque), patrols the shore quite commonly in search of food; Chironomus digitatus is often the sole element in this food.

D. The Sandy Shoals.— Physiographically, they lie between the breaker line and the shore proper, and are therefore about a meter or less in depth. Their extent may be considerable, in places stretching out nearly 300 meters from the shore. Physically, they are composed largely of fine sand, with a very scanty floral growth of Vallisneria, Chara, Najas, and Potamogeton. Physiologically, they are less exposed to molar agents, since the waves lose their main impact at the breaker line; as a result there is a fair growth of vegetation. Yet even with the loss of their main force, the waves are strong enough to prevent the growth of emergent plants, except in much secluded spots; and in these the waves promptly begin to erect a barrier in the form of a bar, thereby cutting off the foreign complex.

Because of the presence of plants, the fauna of the shoals is in many respects like that of the vegetation zone proper beyond the breaker line. No component characteristic of the shores is found in these shoals, except the Chironomid species

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before mentioned. But when we assume that the Chironomid species in question are ammophilous and that by settling on the sandy shore they merely expanded the horizon of their habitat, the apparent discrepancy will be understood.

E. The Bars.—Physiographically bars are continuous with the shore. In all respects the various bars of the lake show the same physical and physiological characteristics as the stony and sandy shores; to all intent they are precisely like these in their faunal makeup. Hence they will not be treated as separate ecological entities, but are to be included in the stony shore association.

2. The Rachion (breaker line).

Physiographically, the rachion is frequently a separate entity, while at times it is a unit with the shore line. This is dependent primarily on the slope of the shore. On steeper shores the breaker line is continuous with the shore line, rocky, stony, or sandy, as the case may be. In shallower areas it is detached from the shore, often several hundred meters from the latter; here, too, it may be frequently divided into two lines,—an "outer" and an "inner bar." Physically, its make-up again depends on its location. If continuous with the shore line proper, it can be recognized by its makeup of rocks, gravel, and sand,—the rocks in the middle, while the smaller ingredients will be piled on either side. In places where a rocky shore extends downward a number of meters, the breaker line is usually recognized by the absence of algal growth at the line and by the gravel heaped on either side. Where the breaker line is detached from the shore, it is easily marked as a stony area some 5–8 meters in width running parallel to the shore. Its middle section is invariably composed of larger stones, while gravel and sand lie on either side. In the larger shallows it is followed some meters closer to the shore by a secondary breaker line.

Physiologically, the rachion, or breaker line, marks the place where wave action and undertow cause the greatest turmoil; it is the point of extremes in lake conditions.

Faunistically, it is comparable to stony shores. Its fauna is largely the same, except that Polycentropus and various Chironomid species are extremely abundant in it. We must dis-

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tinguish, however, between the detached rachion and the continued rachion. Since the latter are found on steeper, hence more exposed, shores, the molar agents will be more violent in these places. Hence, by far the larger number of petrophilous forms are absent from the continuous rachion. On the other hand, the great majority of them are present in the detached rachion. Again, Gomphus fraternus, Epicordulia princeps and Molanna uniophila appear to prefer the sand heaps just beyond the attached rachion, while Amnicola limosa foregathers directly on the breaker line in all parts of the lake in early summer.

3. The Plant Zone.

In the plant zone we have to deal with a double problem,—that of two substrata. The composition of the bottom is to be considered, and that of the vegetation growing upon it. Since by far the larger portion of the fauna is phytophilous, the treatment may be simplified into that of the plant areas, and of the barrens. The plant area of the lake extends from a depth of about one meter to the limit of photosynthesis, which in Lake Mendota is at about 6 meters. This area is interspersed with small barren patches of sand, or rock, while in other places the accumulation of plant marl forms large beds to the hindrance of the growth of the plant itself.

The plant zone may be conveniently divided into two divisions according to the habitus of the plants,—upright plants, and recumbent plants.

A. Upright Plants.— These are formed largely by Potamogeton amplifolius, Najas, and Vallisneria, and more rarely by Myriophyllum and Ceratophyllum. Their characteristic is that they tend to reach the surface, but except for their floral heads no part is protruded. They extend to a depth of about 5 meters, usually less.

Physiologically, they offer the following: (a) exposure to molar agents near surface, (b) plentiful clinging surfaces, (c) a food supply, (d) shelter. On the other hand, since this flora is *not an emergent* one, it offers no foothold for surface breathers.

The fauna must therefore be composed of water-breathers in the first place; beyond this clingers, crawlers, and swimmers of all types may find food, shelter and protection. It is among the

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upright plants that Hydra luxuriates; Planarians find food on the slimy cover of the plants; millions of small Oligochaeta, none of them good swimmers, lope and loop along the plant stems; molluscs of all species except the Lamellibranchiata, Ancylus, and Pleurocera, make these plants their favorite feeding-ground; Hyalella and Hydrachnids are exceedingly numerous among the leaves; among may-flies the ubiquitous Caenis diminuta is prominent; among caddisworms Leptocella uwarowii occurs in prodigious numbers, and much less frequently Triaenodes flavescens, and the small Hydroptilids; among Diptera Chironomus viridis, C. palliatus, and Tanypus monilis are especially phytophilous, while Tanypus fasciatus and Cricotopus exilis will be found less commonly; among Coleoptera Haliplid larvae and the adult of Stenelmis manifest a phytophilous tendency.

B. Recumbent Plants.—These are primarily Chara, Myriophyllum, Ceratophyllum, and the various Potomagetons, except amplifolius; they are most abundant between 4 and 6 meters. Physiologically, they present a more intricate shelter and less exposure to molar activities. Faunistically, much the same biota occur here, but with the difference that Limnaea stagnalis may be found more abundant, and that among caddisworms Helicopsyche, Molanna, and other bottom forms will venture on the trailing leaves of Myriophyllum. Comparably, the forms of the upright plants are less abundant.

C. Barrens.—Certain deposits of plant marl (i. e. the carbonate encrustation of aquatic plants) are frequently found among plants; these are frequented primarily by Tanytarsus exiguus, Chironomus digitatus, and by adults of Stenelmis crenatus. Practically all other species of the littoral benthos favor a sandy bottom. This includes the Lamellibranchiata and Pleurocera among molluscs, Helicopsyche and Molanna among Trichoptera; Chironomus tentans var?, C. digitatus, C. lobiferus, C. abbreviatus, and Tanytarsus exiguus among Diptera, and Stenelmis adults and larvae of Berosus sp. among Coleoptera.

D. The Rock Reefs.—These reefs occur in various portions of the lake, and because of their varying depth are difficult to classify. Primarily, they consist of rocks, slabs, and boulders of considerable size that may come within 3 meters of the surface. In practically all places the reefs are without any admixture of sand or gravel; but their naked surfaces are cov-

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ered with a thick encrustation of an alga. This encrustation gives shelter and food to a considerable number of micro-organisms, so that it can offer some attraction to the fauna of the lake.

Hyalella azteca, Psephenus lecontei and several ubiquitous Chironomids are the only members of the macrofauna that I have found on the reefs. Psephenus lecontei was the biggest surprise of all. This is a rock shore species, which pupates, copulates, and oviposits on land. How it gets to the reefs, how it reaches the land to pupate is indeed a mystery. It is evident, however, that the condition of the substratum is of decisive influence upon Psephenus, for it occurs on most of the reefs, even at 8 meters depth.

The Dysphytal (Sublittoral) Area.

Physiographically, this area lies immediately below the plant area, and marks the limit of photosynthesis. It is characterized by a heaping of slowly decaying plant and other organic matter. It may lie above, or below, the wave limit. In Lake Mendota it happens to coincide with the limit of wave-action (wave-base) and is specifically characterized by the great amount of decomposed shell,—a shell zone. In some of the clear lakes of the north the euphytal or photosynthetic region may extend considerably below the normal wave-base and the shell zone then lies within the euphytal area.

The Shell Zone.—As just stated, in Lake Mendota the shell zone is physiographically coincident with lower wave action, and is marked physically by the great accumulation of shell, with an admixture of mud and sand. The heavier particles carried by the water have been deposited during their transportation from the shore and only the lighter fragments of shell are swept farther downward, where they accumulate by their own weight. Beyond this point only mud is carried.

The shell zone is also marked, in Lake Mendota, by the organic offal from the plant area above. Many of the plants, though uprooted, will be able to maintain themselves for a while, but will finally succumb to the lack of sufficient continued light for photosynthesis.

Hence the following conditions are offered to the fauna: (a) absence of molar agents, (b) absence of clinging surfaces, (c) absence of living plant food, (d) organic waste, i. e., organic

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matter swept from the plant zone above, and slowly decaying below, (e) a bottom composed of shell, mud, waste, giving ready shelter, but also permitting easy access to enemies.

The fauna meets these requirements in the manner outlined. By far the larger number of species are tube-builders and burrowers, while the remaining ones are well protected by cases. Molluscs are very common in the shell zone, especially the Gastropoda; Leptocerus sp. frequently attaches its cases to the shells of the larger snails, and is carried about by them. Swimmers are the Hydrachnida, and Corethra frequently. Outside of these the fauna consists largely of the tube-builders: worms, Limnodrilus and Tubifex; Diptera, Chironomus tentans, lobiferus, and Protenthes choreus; the Lamellibranch, Corneocyclas idahoensis; and of the burrower Sialis infumata. In food habits practically all of these are scavengers, or carnivores; among the latter Sialis and Corethra are dominant.

The Aphytal Area.

This signifies the plantless area. Physiographically, this area merges imperceptibly with the dysphytal area. It is more easily definable on a physiological basis. Its area covers that part of Lake Mendota below the shell zone and extends to the greatest depth of 25 m. Physically, its makeup is of fine mud with an admixture of shell, silt, grit, organic and coprogenic waste, varying in different parts of the lake. This composition of the bottom seems to have considerable influence on the horizontal and vertical distribution of the fauna, as shown by S. Ekman for Lake Vaettern (1915); in Lake Mendota, however, it is not this physical factor which determines the vertical distribution of the aphytal area, but the physiological factor of thermotic stagnation. This stagnation results in the establishment of a region of variable extent for a variable period,—the hypolimnion, a region of low temperature, in which the oxygen content has been used up in the formation of CO_2 and methane by decaying organisms.

The aphytal area therefore offers the following conditions: (a) an absence of O_2 from the bottom waters for several months of the year, and a corresponding increase in CO_2 and CH_4—hence anaerobic conditions; (b) low range of temperature—hence stenothermal; (c) a bottom of mud of varying admixture; (d) food consisting of deflux.

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It will be seen that the decisive factor here is respiration. Unless the animal can escape or withstand the periodic anaerobiosis it is obviously barred. Once having adjusted itself to this condition the composition of the bottom will determine its horizontal distribution. Food will be of tertiary importance.

If, bearing this in mind, we examine the macrofauna of the aphytal area we find that adjustment to anaerobiosis is effected by two methods: migration and aestivation. Migration applies to pelagic forms like Corethra and Limnesia histrionica, which swim directly upward to oxygenated water; and to Sialis infumata, which retreats as the hypolimnion progresses outward and upward.

Aestivation, coupled with the storage of oxygen, is the more common adjustment. Species like the Chironomids Chironomus tentans and Protenthes choreus, are able to store oxygen.

Since the aphytal area adjoins the dysphytal area (here the shell zone), the fauna of the two are related. That is, the species of the aphytal area and the shell zone are alike to a certain extent, but there are more species in the latter; for quite a number of these have been unable to adjust themselves to the deoxygenation of the summer months. Although the shell zone marks the lower limit of wave action, this activity is too little to affect the composition in any other way than through its selective heaping of débris.

DISCUSSION.

Notwithstanding the fact that the lake taken as a unit is a place of relatively slight and slow changes, it contains within itself a series of well defined habitats, each with its own controlling factors and its own biota. For the lake as a whole molar agents through their influence on respiration are undoubtedly most decisive. But for the species established in the lake certain additional factors must be taken into consideration.

For example, why should certain Chironomid species prefer plants as a substratum, others mud, and still others sand and rocks? Why should certain species, especially of the genus Tanytarsus, be extremely localized in their distribution? Of Tanytarus I know of four species in the lake, and five or six elsewhere, all of which are found in numbers in a very definite spot and nowhere else. Again, why should certain forms be

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so varied in their diet, others so restricted? Why should certain caddisworms be algophagous, while others feed on any plant and will readily eat animal food?

It is evident that the commoner forms have a wide range in more than one respect. Thus, for instance, Chironomus lobiferus is nearly an ubiquist as to distribution, and holophagous as to food. It should then follow logically that the most widely adapted forms are the most plastic; that this plasticity will result in the numerical preponderance of the plastic form.

Table 8 shows that many species are found under widely differing conditions. Yet in every single case one habitat seems to offer the optimal conditions, and it is in this habitat that the species attains its maximum representation. But it is rarely indeed that a plastic species dominates in its optimal habitat. What I mean to emphasize is that plasticity may insure continuation of the species, but that it does not necessarily result in dominance. To illustrate, Chironomus digitatus and C. lobiferus are both plastic forms, the latter more so than the former; yet while both are very common in different areas, neither of the two dominates in any area, and their numerical total for the lake is inferior to that of many species that attain a local dominance. (See p. 480).

Dominance is relative in each group. Twenty Hyalellae per square meter along the shore I would regard as a small representation, while an equal number for Leptocerus ancylus would mean dominance. Yet Hyalella dominates among the Crustacea of the shore, while Psephenus lecontei dominates among Coleopterous larvae. But no single species dominates among the biota of the shore line. Psychologically, any impression of dominance is linked to bulk,—fifty Heptagenia larvae will look more numerous than a hundred Hyalellae,—so that an estimate can only be relative.

No species dominates the biota of the entire lake. But for the plant zone the caddisworm Leptocella uwarowii comes nearest to complete dominance of any form in the lake, while Sialis infumata is prominent but not truly dominant in the dysphytal area. In the aphytal area, however, we have a curious simultaneous dominance of Corethra, Chironomus tentans, Protenthes choreus, Corneocyclas, and of Limnodrilus and Tubifex. These biota of the aphytal area form a bigger contingent of the lake complex than nearly all other forms taken together. It is

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probably by virtue of their resistance to anaerobic conditions that they attain their eminence. But in every instance it is rather the stenoplastic species which may dominate than the euryplastic one.

On the basis of physiological, physical, and biotic aspects it is possible to divide the lake into the various habitats listed. The following summary presents in briefest form the major evidence. The animals can be included in this summary only according to habitus and type, not according to species.

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Ecological Summary of Lake Zonation

Area:	Physiography Depth	Characteristics		
		Physical	Physiological	Biota
LITTORAL=Phytal				
A. Eulittoral=Euphytal				
1. Shore Line	0-1 m.	Varied	Strong molar agents, extremes of temperature, intermittent feeding.	Forms with shelters, clingers, burrowers: visitors=swimmers.
a. Rock	0-1 m.	Rock, boulders, rough aspect.	Strong surf, food=Cladophora.	Cladophora-pliant and clinging. Animals either flattened, or with flat shelter, or with appressed methods; clingers.
b. Cobbles (stony)	0-1 m.	Stones, pebbles, sand, smooth aspect.	Fluctuating rubble, food scant-less Cladophora, fewer clinging surfaces.	Fewer clingers, no crawlers, many burrowers and visitors.
c. Sand	0-1 m.	Sand, with pebbles.	Shifting bottom, no clinging surfaces.	No vegetation, no clingers; visitors, and burrowers,
2. Rachion (breaker line).	1-1 ½	Stones with pebbles.	Greatest wave action and undertow, little plant food.	Burrowers, strongest clingers, sheltered species, swimmers,
3. Plant Zone	1-6 m.	Upright plants. Potamogeton, Najas, Vallisn. Bottom sand.	Exposed to molar agents, clinging surfaces, abundant food, shelter.	Clingers, crawlers, swimmers, no specially adapted species. Phytophaga and carnivora.
a. Upright plants	1-5 m.			
b. Recumbent plants	4-6 m.	Plants bent and trailing.	Less exposure to molar agents, greatest photosynthesis.	Clingers, more crawlers, swimmers.
c. Bottoms	Various	Sand, plant marl, rarely mud.	No exposure, food waste and plants	Crawlers, sprawlers, swimmers, chiefly phytophags and carnivores, some necrophags.
B. Sublittoral=Dysphytal				
4. Shell Zone	6-8 m.	Shell, with sand and mud	Lower limit of wave action, food=waste, dying plants	Crawlers, burrowers, tube-dwellers, scavengers, carnivores.
APHYTAL=Plantless				
C. Aphytal Zone	7-25	Mud, with defiux	No molar action, slight activities anaerobic for several months, stenothermal.	Anaerobes, tube builders, burrowers, swimmers, aestivators.

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II. THE SEASONAL CYCLE.

Probably the most characteristic feature of the annual cycle is the brief ascendancy of plant life during the summer months, and the synchronous maxima of many forms of animal life. So closely are these two connected, so interdependent, that the plant ascendancy may be assigned as the direct cause of the faunal ascendancy. The seasonal succession is not continuous, but really composed of a series of maxima.

Vernal Succession—Period of Elimination and Transformation.—After the ice has gone out, a very small number of plants will have survived; most of them are but a few inches in length. Growth is rapid, and by middle June most of them are able to send their floral heads to the water surface. But in the meantime the filamentous algae of the lake, especially Cladophora and various Spirogyra, have increased to a prodigious extent. If molar agents have not been too severe, the great waving plumes of Cladophora will form a miniature wilderness along the shores, while Spirogyra, Anabaena, Hydrodictyon and other algae will cover the plants and the bottom of the vegetation zone with a green film, and also form immense mats of scum in the shallow cut-offs. Among higher plants Castalia, Nymphaea, Lemna, and Myriophyllum, dominate behind the bars; in the lake Myriophyllum, Ceratophyllum, and Potamogeton species, though short, send forth long spiral stems with floral heads protruding above the surface.

This period lasts till the water temperature rises above 16° C., after which Cladophora decays very rapidly and disappears; by the time a temperature of 18° is reached only the younger and more resistant growth will be found.

The animal life of this algal period is characterized chiefly by a series of periodic eliminations rather than by any distinct dominance. In April large series of the less common Chironomid species leave the lake, including Cricotopus exilis, Chironomus modestus, and a varying number of C. tentans and C. plumosus. Early in May the annual shore migration of Sialis larvae takes place; in certain parts of the shore armies composed of many thousands may be observed climbing up some small drain or ravine. Two weeks later the adults may be seen laying their eggs everywhere on branches overhanging the water's edge.

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Coincident or slightly before the appearance of the adult Sialids, Chironomus digitatus will emerge, followed shortly afterwards by C. tentans, plumosus, and lobiferus. A little later, about the time the eggs of Sialis hatch,—that is, in early June,—there begins the exodus of mayflies. Usually about the first week of June Ephemera varia emerges, followed at once by millions of Caenis diminuta, and in quick succession by Ecdyurus and Heptagenia. Before the middle of June their flights are past.

In the lake shallows, that is, in the cut-offs behind the bars, the imagos of Enallagma, Ischnura, Nehallennia, some Libellulidae, and Chrysops are conspicuous. They may be seen flying up and down, mating and ovipositing. The leaves of Castalia especially will show large batches of eggs of the various Zygoptera, Chrysops, and Donaciinae on the upper or under surfaces.

So many species have been eliminated from the lake by this time that the remaining ones attain a temporary dominance. Thus, the encrusting sponges and Bryozoa are conspicuous in the rocky areas, while among Cladophora and Spirogyra millions of the small Hydroptilids and the Ceratopogonine larvae will be found. For a fortnight the migration of young Nematodes, Gordius aquaticus and a pink Nematode, makes them quite conspicuous in all parts of the lake. Of other species Amnicola limosa is euryedaphic at this time, but seems to favor especially the breaker line where it gathers in clusters exceeding a thousand specimens per square meter.

Summer Succession—Period of Multiplication and Growth.—With the disappearance of Cladophora there is an intense growth of spermatophytes. Various species of Potamogeton, but especially P. amplifolius, Myriophyllum, Ceratophyllum, Vallisneria, Najas, and Chara luxuriate and with their rise begins the tremendous ascendancy of Trichoptera and small Oligochaeta.

When the temperature of the water reaches about 15°, there begins the long series of wave-like "flights" of Corethra. These occur in pulses about ten days apart, and last throughout the summer until the middle of September. Their climax is reached about the middle of July.

These Corethra flights initiate what may be termed the "summer succession," in contradistinction to the "vernal succession" which ends with the appearance of the may-fly species

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and the first damselflies. Since pupal and adult stages of the various species overlap, and since many of them have a very brief pupal stage, I shall refer to these explicitly.

In late June and early July the Ceratopogonine larvae pupate and after two to four days appear as adults. The case-building caddisworms which have pupated during late May and June leave their cases about the same time and appear as adults, being conspicuous for a few days. In the latter half of the month the Hydroptilid caddisworms emerge after a brief week of pupal life. The larvae of Psephenus lecontei go to shore to pupate and their adults emerge in the early part of August. Simultaneously with their emergence, the pupal life of Stenelmis crenatus is begun, lasting for about ten days. Dikerogammarus for some reason is quite conspicuous at this time, while the young Hyalellae (fertilization takes place in late June) appear to dominate for a brief period.

All of these may in a way be said to prepare for the great climax of late August and early September. The eggs of caddisflies which were laid in early and middle July hatch at once (I exclude those of the Hydroptilids which do not hatch until the following year) and grow in quick stages. It seems little more than a month before the caddisworms have attained their full size. Hence by late August practically all of them are full grown.

Now, this maturity is practically synchronous with the numerical culmination of the small Oligochaeta and the greatest proliferation of plant life. To the student it seems as though the caddisworms and Oligochaeta received a sudden impetus which carried them to a rapid climax. This climax is indeed a remarkable one. Every plant, each leaflet, the bottoms of the plant zone, all will be found covered copiously with caddisworms,—especially with Leptocella uwarowii and Helicopsyche borealis,—and with small Oligochaeta. But while the Trichoptera appear greater in bulk, the small Oligochaeta outnumber them a thousand times, although they seem less in mass by reason of their transparency and their smaller size. So great is this multiplication of the Oligochaeta that they cover the leaves and stems of some plants like an animate scum.

This ascendancy is paralleled to a lesser extent in other groups. Hydra proliferates in enormous numbers, but seems to attain its climax somewhat later in the season. Planarians,

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so scattered early in the season, are extremely abundant and practically ubiquitous. The same is true of leeches, Hydrachnida, and smaller Bryozoa. Among insects the shoreward migration of the larvae of Ephemera varia is of interest; that is, the younger larvae have lived in the sands of the plant zone during early summer, and the older larvae now migrate to their habitat in the rachion and stony shores. Among Chironomids Chironomus digitatus, lobiferus, fulviventris, viridis, palliatus, and others reach their larval maxima at this period.

Autumnal Succession—Period of Diminution.—The ascendancy lasts till early September, when there is a falling-off throughout the lake community. While the falling temperature may effect this to some extent,—for instance, in the case of Corethra,—it is probable that the molar agents in the form of equinoctial storms are the most important factors. Lake circulation is quickened by the storms and the falling temperature, and the return of oxygen to the aphytal area stimulates the anaerobes and adjoining bottom fauna to renewed activity.

Sialis at once migrates downward to the newly accessible feeding-ground. The return of the oxygen stimulates Chironomus tentans and Protenthes choreus to pupation and there follows an autumnal flight of these species. Some of the Tanytarsus species of the dysphytal area are also stimulated to transformation, but they do not form any conspicuous element such as their relatives.

Some of the autumn storms are of great violence and the havoc wrought by them among the plant and animal life of the lake is immense. Potamogeton, Najas, Vallisneria,—practically the entire upright vegetation is broken loose; much of it is cast ashore, portions are set adrift on the lake and later on sink to the bottom.

Much of the faunal life of this vegetation is cast on shore or battered to death in the surf. In November, 1914, after one of these storms, there was a great shore drift in Sunset Bay, between Picnic and Sunset Points. This drift was some 30 meters long, about 2 meters wide and 15 cm. deep, and was composed almost entirely of dead Leptocellae in their cases. A second drift, even greater in extent, lay in the water. According to an estimate, there were at least five million specimens in this drift. And this was only for a very small portion of the lake off Sunset Bay.

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The same storms bring about the death, no doubt, of many other aquatic animals. Dead crayfish, Hyalellae, Ephemerid larvae of various kinds, and other forms are a common sight along the shores after a vigorous storm, not only in the autumn, but also at other times of the year. But the autumn storms bring about a rapid stripping and cleansing of the entire littoral area, and by late November only a very short young growth is left in the different parts of the lake.

The Winter Period—Period of Torpor, Suppressed Activities. There remains the winter life of the fauna. The removal of the greater part of the flora has destroyed the clinging surfaces for most of the species, and they are obliged to become bottom dwellers for the winter months. Plant growth goes on during the winter, even under the ice, but it is so slight that it cannot be regarded as a direct factor.

In general, the winter period can be regarded as beginning at the time of the greatest density of the water,—at 4° C. This water sinks to the bottom, and hence there is the reversal of the summer condition,—namely, warm water below and cold water above. The lowered temperature inhibits the activities of many species and these may become more or less dormant. As a whole, physiological activities are lowered, and hence there is a corresponding lowering of food requirements.

That there is no complete cessation is evidenced by the activity of fish, plankton Crustacea, Corethra, Ceratopogoninae, and other groups. There is, however, a general diminution or deferment of activities. Once the ice covers the lake, many species become entirely inactive. The amount of light penetrating the ice depends on its quality—whether smooth, rough, or stratified,—and the amount of snow upon it. The problem of continued darkness makes the feeding of animals precarious and, in general, the discriminating feeders become dormant.

For the surface-breathers of the lake shallows, ponds, streams, and other waters, a new era sets in,—the period of dormancy. For a while, indeed, many of the surface-breathers are very active under the ice (Wesenberg-Lund), hunting to and fro in quest of food. Their oxygen is obtained from the bubbles secreted by the plants under the ice. Soon, however, the ice will be too thick and the light for photosynthesis will be insufficient, —hence no more secretion of oxygen,—and the animals will dig into the mud and become dormant for the winter.

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This dormancy appears to be a definite seasonal instinct and persists even among the surface-breathers frequenting homoiothermal waters which never freeze. But curious to say, while the Gyrini, Dytiscidae, Tipulid larvae, and other surface-breathers occurring in these waters may be evident a little longer than their relatives of the frozen ponds, sooner or later they, too, burrow into the mud or silt of the homoiothermal waters and remain so for several months.

For the shore animals winter brings a new problem which is as difficult as any offered by more temperate conditions. This is the problem of ice,—of the freezing of their habitat. Many forms such as some species of caddisworms, may-flies, and leeches, appear to recognize the danger by migrating downward toward the breaker line or even below that point. This migration apparently occurs between 4° and 1° C. But to my surprise I have found that many other species, including Psephenus lecontei, Stenelmis crenatus, Erpobdella punctata, Nephelopsis obscura, Heptagenia, Sparganophilus eiseni, and others, make no attempt at all to escape downward. I have found them close to the shore margin, with less than 2 cm. of water between the ice (then 15 cm. thick) and the bottom; later on I have found them packed for days and weeks in mush ice which had been forced under the ice-sheet proper by heavy winds. The mush ice in the shore area would be practically continuous with the surface ice.

It can therefore be supposed that they die by freezing, or that they can resist the influence of cold, or that their survival is purely accidental. One thing is certain,—and that is, when spring comes the identical shore will have its normal biota, and apparently without numerical impairment. Whether this biota is a "survival," or newly recruited, I have been unable to ascertain with certainty, although I believe that the former is the case. There is always the possibility that the ground temperature is sufficient to keep a thin sheet of water between the ice and the bottom proper, in which case a "zone of safety" would be established; this would explain the survival of the shore dwellers, and some condition like this "zone" seems to be indicated by various examinations made in the winter of 1914–15.

Before the ice goes out in the spring, animals become active again. Ground radiation raises the temperature of the water during late winter, so that it approximates 4° C. at the bottom.

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Long before the ice goes out completely, some early insect species become active. In places where the entry of homoiothermal spring water keeps an open area in the lake, insect larvae will begin to transform. As a matter of fact, such transformation (pupation) may take place even when the lake is completely covered with ice. For instance, Pearse (1916) captured perch from Lake Wingra in early March, which contained largely Tanytarsus dives, half of them pupae; this was at a time when the lake was completely covered with ice, which did not go out until a week or more afterward. A similar condition exists in ponds and other waters, and some species appear to be able to measure the time so closely that the period of their emergence and the going out of the ice seem to be synchronized to the hour.

To other species the disappearance of the ice means the inception of larval life. There are not many such species in the lake, the Hydroptilid caddisworms being the most prominent. But especially among surface-breathers of the other waters spring means the beginning of active life; while in the lake it means primarily a continuation of larval life for at least the insect biota.

III. FOOD RELATIONS.

A. Reciprocal.—With the varying influence of molar and other agents it is not to be wondered at that the averages of food supply fluctuate from month to month and from year to year. The greatest fluctuation, however, is the seasonal one, and is best expressed in a table of comparative percentages. These percentages can refer to bulk, not to numerical representation. In table 9 I have attempted a bulk calculation for two seasonal periods, and an annual estimate for comparison. The seasons represent the two great floral periods of the lake,—namely the algal period of May-June and the spermatophyte period August-September; or, from an animal standpoint, the elimination period (= transformation) and the multiplication period referred to in the discussion of the seasonal cycle. I have not included the fish in the summary of the macrofauna; too little is known of their numerical representation. (See p. 482).

A comparison of the bulk percentage and the food relations of the various groups shows two important results: (1) The scavengers are the dominant forms of the lake; (2) Trichop-

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tera are dominant in the littoral area, hence in the region of plant food. A third point is indicated,—and that is the ready passage from a microphagous diet to any other. Among the scavengers can be listed Annelida, Gastropoda, Corethridae, and Chironomidae; while among the phytophaga the caddisworms have attained a single dominance. It is indeed surprising that of phytophagous aquatic groups only the caddisworms attain a prominent place in the lake complex; and since even caddisworms will readily resort to a sarcophagous method of life, the place of plant food in the lake complex becomes minimized as a primary source of food, while emphasized rather unexpectedly from the viewpoint of waste food.

B. Fish Food.—The greatest element of surprise of the food relations lies in the study of fish food items. These items are not linear in their proportions to the available food supply; I mean to say that the different groups do not form the same percentage of fish food that they form of the lake complex. In the way of food fish will naturally choose first the free-living forms, secondly plant clingers and crawlers, thirdly burrowers and tube-builders. But the depressed and appressed clingers and protected types of the shore areas seem to be quite absent.

The commoner supply of food is formed by the Diptera primarily among insects, next to which come Sialis and Hemiptera (the latter in the lake shallows). Along the shore line Chironomus lobiferus and C. digitatus are the main source, while in the aphytal area Protenthes choreus, Chironomus tentans, Corethra, and Sialis infumata are the chief representatives.

Again, certain faunal types are comparatively rare in fish diet. Thus, while Leptocella uwarowii forms practically 90% of the caddisworm fauna of the lake, it forms probably less than 25% of the caddisworm diet of fish, while the whole caddisworm diet amounts to hardly more than 2% of the total fish food. This proportion is not at all commensurate with their availability and we have to look elsewhere to account for this disparity. Perhaps it is the secretions which make them less agreeable as a diet, although along this line other species and the notably repellant Hemiptera form a favorite diet wherever available. To me it seems that the length, rigidity, and general unwieldiness of the cases play a big part in the selection of this particular item; small fish cannot manage the cases at all, while

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larger fish have difficulties in breaking and swallowing them because of their rather pointed ends and the considerable stiffness of the tubes proper.

As for repellant secretions, most of the red Hydrachnida are refused by the general macrofauna, but not by the red Hydrachnida themselves. Apparently, therefore, they are obnoxious or distasteful; yet individuals of Atax turgidus, Eylais, Hygrobates, and other red genera are too frequently present in fish diet to permit a sweeping statement as to their offensiveness. This applies equally well to other types, such as the various Corixae and Gyrini, especially to the adults of the latter. Fish of various species frequently gorge themselves on Corixae, and adult of Gyrinus are not uncommon in fish stomachs. Yet these are all well-known instances of supposedly well-protected species,—at least that has been the assumption of the purpose of the emanations from these species. The facts of fish food would tend to force a change or modification of these assumptions.

As a whole, the place of insects in the fish diet is a variable one, and fluctuates with the habitat and the species of fish. Insects compose about 60% of the macrofauna of the lake, excluding fish, and their bulk percentage in fish food is equal, or near, to the same figure. Taking the insects as a unit, the Trichoptera form 30%, and the Corethridae and Chironomidae 65% of the supply. The actual use, however, appears to be Trichoptera 5%, Corethridae and Chironomidae 90%.

The Lake Toll.—As an irregular source of fish food must be mentioned the thousands of insects which are blown from the land, and such that venture too near the surface in the chase of food and become water-trapped.

In the first category can be placed myriads of Lachnosterna, mayflies, Corethra, bees, ants of various species, wasps, and many other, less common insects. In the second category belong primarily Odonata and Asilidae. Although expert fliers, Odonata frequently become water-trapped in a too eager quest of prey, often of their own kind. Yet they are often able to free themselves, especially if the surface is somewhat disturbed; it seems that they wait for an opportune wave-crest to lift them slightly above the surface and this is sufficient to give them the initial freedom of wing movement.

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As for Asilidae, these have a penchant for damselflies which invariably try to escape over the water. The latter are able to fly exceedingly close to the surface film without touching it and this ability is an effective means of protection. The pursuing robber-fly frequently ventures too close and becomes trapped by the water. It is surprising that in the ensuing struggle to escape from the water the robber-fly should come to lie helplessly on its back, the wings held firmly by the surface film. Here, too, slight wave action may overturn the captive Asilid and give an opportunity to escape from the water. Hundreds of robber-flies were observed during the summer of 1914 trapped in the fashion described.

The Role of the Scavenger in the Lake Economy.

In a previous portion of this paper I mentioned the fact that from a bulk standpoint, and much more so from a numerical standpoint, the scavengers predominate among the lake fauna. The supply of fresh plant food is comparatively restricted in the lake, not only in quantity but also in time, while great amounts of waste are accessible in the way of decaying plant and animal matter and inorganic waste.

Thienemann (1911), Lauterborn (1905, 1912), and especially Rhode (1912) have pointed out that certain halophilous species of Chironomids are regularly associated with the sulfuretted inorganic waste of certain manufactories, while others are invariably associated with the sewage and drainage systems of many cities.

Among the halophilous species Rhode found several which are able to exist in inorganic waste of an especially high concentration of Na and K; in fact, of a concentration exceeding that of sea water. (This recalls some species of Ephydridae—Aldrich 1912). There they were associated with fungi, flagellates, and bacteria.

Other species were found in tremendous numbers in the sewage water of cities, where they were associated with Tubifex, and some rare fungi. In both cases, that is, in the presence of inorganic and organic waste, the concentration of certain mineral compounds was quite abnormal, and it is difficult to understand the possibility of life under some of the conditions found. For instance, an extreme was Chironomus gregarius which was

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found in mineral waste containing a concentration of 5.5% NaCl.

Chironomids have been found so regularly in drainage and sewage water (they are constantly mentioned in reports on sewage) that it has been suggested that they play an important rôle in sewage disposal,—indeed, a part akin to the sewage bacteria. Such a rôle appears to be held by the Chironomids and worms of the aphytal area of the lake. They are scavengers in the broadest sense, even coprophagous, and that they may aid if not entirely take the part of, the sewage bacteria in the lake seems not unlikely.

Part IV. COMPARISONS AND SUMMARIES.

In discussing lake life, the prime question confronting us is: "What are the advantages of aquatic life, particularly of lake life?" Why have so many insects reverted to acquatic life? It is easy to understand why animals which are holaquatic in the first place should remain so, but once a terrestrial mode of life is acquired a change is more difficult to understand.

Except for Odonata, Ephemeroidea, Plecoptera, and some Neuropteroidea, aquatic life is secondary among insects. That is, while the insect progenitor was aquatic, and the oldest insects were amphibious, their descendants largely adopted a terrestrial mode of life. The above mentioned orders, however, appear to have retained their primitive amphibious life. Other orders, such as Diptera, Coleoptera, Hemiptera, and Lepidoptera, became holoterrestrial, but many of their modern representatives have again adopted an amphibious life.

As to the why and wherefore, we have not far to seek. A terrestrial mode of life entails adaptations to a series of extremes. Sudden and often extreme changes of temperature, of winds, variations from drouth to flood, from dust to mud, and the like, are all of a kind to require considerable adjustment on the part of the organism. When we consider the additional need of food and of shelter from enemies, we cannot wonder that so many insects,—indeed, the greater number of them—have acquired some means of procuring additional shelter at least for the larval stages.

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The most general methods of concealment adopted have undoubtedly been subterranean and endophytous shelter,—chiefly among the holometabola; endophytous life is in certain respects (plant-borers and miners) a variant of subterranean life. Both modes are successful in that they offer shelter from extremes of climate and protection from enemies, less successful in that they largely restrict the self-feeding larvae to a limited supply of plant food.

The ease of burrowing in soft or moist ground led animals to a wet substratum, and finally to a purely aquatic environment.

We find within several orders, even within families, practically all of these transitions (see tables 3 and 4, Diptera and Coleoptera). Other species may have adopted an aquatic life more directly.

The advantage of aquatic life is that this environment offers a greater uniformity of conditions and a plentiful food supply. Conditions are not extreme, changes are slow, and the animal is easily able to adjust itself to these without any special morphological adaptations. But the aquatic environment necessitated certain physiological adjustments, especially along respiratory lines, and it is by the perfection of these adaptations that species indicate the degree of aquativeness (i. e., adjustment to aquatic life) attained by them. This aquativeness has been developed to its highest point in lake life and in rapids, where molar agents have forced a complete separation from aerial respiration and a resultant total aquativeness.

Rapids.—When comparing other hydrobiota with the lake, we find a rather marked resemblance between the rapids and certain exposed portions of the lake,—i. e., the shore and the rachion (Wesenberg-Lund 1908, Steinmann 1907). The same may-flies, leeches, beetle-larvae, and caddis-worms are found in the rapids. On the other hand, certain stenophilic species such as Simulium, Chironomus tenellus, Baetis pygmaea, Hydropsyche alternans, and others, are conspicuously absent from the lake shore. For while the latter offers current at intervals, these stenophils demand a persistent current, hence are homoiophilous. Experimentally, I have placed Simulium and Hydropsyche alternans larvae in a jar where the current would sweep around the jar, but not into it; most of the larvae died within two or three hours, despite thorough oxygenation and repeated change of water.

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Yet the community of forms and adaptations of both habitats is sufficiently pertinent to indicate a probable common origin (Steinmann 1907). Both faunas consist largely of appressed clingers and some burrowers, all are well protected or sheltered forms (except Simulium, which is specialized in an entirely unique direction.) Both complexes do not admit of air-breathers, that is, as residents; for the air-breathers so frequently found in the slack water of rapids are not residents in the sense of permanence. They exist because the current does not reach them; and if it should they would be unable to maintain themselves. No emergent plants or submerged spermatophytes will be found; Cladophora and some other filamentous algae are able to maintain an appressed growth where the current is not too strong.

The current considerably modifies the shelter, and the food and breeding habits of the biota. The constant current prevents the biota from wandering about; as a rule an individual remains fixed for the greater part of its life. Strong fastholds in the way of strong claws, suckers, and other means are possessed by most of the biota, while the few swimmers (Hydrachnida, fan-tail darter) have especially elaborate swimming structures. Shelter must be sought under rocks, where the force of the current is somewhat broken. The eddies behind the rocks are favorable feeding grounds, since much of the flotsam passing over the rapids finds its way into the tiny eddies and whirlpools about the rocks. Some animals have elaborated their holding devices to trap this flotsam; such are the caddisworms of the rapids, whose webs are generally supplied with sieves and nets for food-capture. Other animals of the rapids, such as Simulium and the may-flies, have elaborated their mouthparts into "nets" through which the water is strained for the micro-organisms which comprise their food.

Most of the insects of the rapids at the time of their final ecdysis float to the surface, where the pupal skin opens at once and the adult flies upward, an adaptation insuring the safety of the species. In oviposition some species (Odonata) dip their abdomen into the water and let the current carry the eggs away; others (caddisflies) may lay their eggs at the water's edge or enter the water and fasten the eggs to rocks. The latter applies specially to stenophilic species.

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More than any other fauna that of the rapids is in danger of extinction during the winter period. Frequently the rapids may freeze solidly, and with the friction of slowly moving rocks and ice pressure all animate life is destroyed. As a matter of fact, the insects do not hibernate in the larval stage in the rapids; long before the rapids freeze up, the fauna has become reduced, and the larvae present are comparatively few.

Springs.—The outlets of springs are frequently miniature rapids and may approximate the conditions of rapids. But they are nearly always characterized by an abundant growth of water cress, among which one is certain to find air-breathers such as Hemiptera and Tipulid larvae. This is a striking example of the dependence of surface-breathing species on plant growth for their maintenance.

The most important character of springs is the temperature, which as a rule is constant throughout the year. The numerous springs about the Madison lakes are all homoiothermal, with a temperature of 8–10° C. the year round. The outlets contain an abundance of water-cress, in which caddis-worms, snails, crustacea, and planarians are exceedingly plentiful. Some of the typical representatives are: the caddis-worms Neophylax autumnus, Platyphylax designatus (more truly a rapids form), Limnephilus rhombicus, the latter with both vernal and autumnal cases at the same time, an interesting persistence and overlapping of a seasonal instinct. Among planarians Dendrocoelium lacteum and Polycelis nigra are especially common, while Planaria doritocephala and P. agilis are quite frequent, all four species occurring also in the lake; Physa gyrina and P. heterostropha among Gastropoda; and Gammarus limnaeus among Crustacea.

It is difficult to decide which factor controls the fonticolar association, whether it is current, food supply, temperature, or chemical composition of the water. This much is certain: the springs about the lakes vary as to their biota. Thus for instance, Merrill Spring outlet contains an abundance of caddis-worms and Planarians, while Merrill Creek close by, which is fed by springs, contains not a single Trichopteron or Planarian. The conditions appear to be similar to Merrill Spring, but differ in the chemical makeup of the water, due to additional drainage water and the composition of its basin. In places the Merrill Creek rapids exceed those of the spring's

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outlet in swiftness, and Simulium has established itself in such spots, an indication that current may be the decisive factor for Simulium, while the chemical composition of the water appears to be the only factor which prevents its associates of the Yahara spillway from establishing themselves also.

This situation further indicates that the conditions required by even a stenophilic species are relative and that the fluctuation of conditions resulting in an intergrading of hibitats is paralleled by a corresponding intergrading of the respective biota.

In their general makeup the associations of the lake, rapids, and spring outlets are distinctly related. They may be said to form the water-breathing communities. In contrast to them may be placed the communities of streams, creeks, ponds, swamps, and shallows, as typified by air-breathing animals.

Appendant Lake Shallows.—Certain parts of the lake have shallowed out and have been cut off by means of bars so that they no longer need be considered a part of the lake proper. Yet these shallows are of enormous importance as food sources to fish ,especially to the shore fishes, and as breeding places for a great number of species, especially among vertebrates and surface-breathing insects.

The shallowing process, frequently a result of sedimentation by inflowing streams or of the swamping due to the invasion of an emergent vegetation, and the lessened exposure to molar agents favor the abundant growth of an emergent and floating flora, such as Lemna, Nymphaea, Castalia, Typha, and others. In this respect the outlying lake shallows are akin to the swamps which line the Yahara River along its course. It is to be expected, therefore, that the fauna of the shallows will also be similar to that of the swamps, and that is precisely the case.

The fauna consists chiefly of surface-breathers of various kinds, including vertebrates, but it also includes many of the water-breathers found in the lake, especially inhabitants of the mud bottom. It is marked by the considerable number of Culicidae, Chironomidae, Syrphidae, Anisoptera, Hemiptera, and Dytiscidae, but it has a very scant representation of Ephemeridae, Trichoptera, Zygoptera, and Hyalellae. Stagnation is, of course, very great in the swamps, and this means that to some extent anaerobic conditions may prevail on the bottom for short periods. This may be an important factor in determining the faunal complex.

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Decaying plants, and mineral matter tend to form an organic sediment of varying thickness. In places this sediment may constitute a layer of considerable thickness; it will be a false bottom, for while it may bear a fair amount of stress, any considerable pressure will pierce this layer. This sedimental layer is quite impervious to heat, absorbing little and permitting none to penetrate, so that the wet soil beneath will be found quite chilly by comparison with the warm water above. Decomposition and acidification are important factors in swamp physiology and probably of great importance in determining the faunal complex; yet too little is known of this phase of the subject to permit any detailed analysis.

Whatever the factors be, given a slight current, the fauna immediately changes certain of its aspects, perhaps because of the removal of the chemical deterrents. This can be observed admirably in the swamps of the Yahara to the north of Lake Mendota and south of Lakes Monona and Waubesa. Where the water is stagnant the fauna lacks Trichoptera, Zygoptera, and Hyalellae; but in presence of a fair current these groups are well represented.

Streams.—As just stated, a stream differs from a swamp in that it flows, while the swamp is stagnant. The degree of flow is, of course, relative. Much also depends on the composition of the bottom. Given a sandy bottom and another of mud it is probable that the muddy stream will support little plant life while the sandy stream will be choked with vegetation.

The composition of the substratum is of the highest importance to the biota of the stream. No better examples of this exist than Pheasant Branch Creek at the western end of the lake and Six Mile Creek flowing in at the north. Pheasant Branch Creek is a narrow, rapid stream, about 6 meters wide, a little over a meter deep, with a bed of mud covered with silt. The water is clear. The creek contains a luxuriant vegetation of Lemna, Myriophyllum, Ceratophyllum, and Elodea, in which a very rich fauna maintains itself.

Six-Mile Creek is a slower stream, with a very tortuous channel, varying in width from 8–12 meters, with a depth of 1–2 meters. Its bottom is mud and clay. Its water is murky and no vegetation exists in the bed of the stream, except for an occasional Nymphaea and Castalia; hence the animal life is essen-

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tially that of the lake shallows, chiefly Ephemeridae, Aeshnidae, and Libellulidae.

Again, the Yahara River, passing through the swamps on the north, of Lake Mendota, carries with it a great deal of sediment, which makes it murky in its middle portions. Through its own force it is able to keep its channel unobstructed to a depth of about 3 meters. In this murky part no vegetation and an exceedingly scant fauna exist. But in the shallower portions on its side the fauna and flora are of the stream type, with an especially large representation of caddis-worms (chiefly Setodes grandis), damselfly larvae, and Hyalellae.

This relation shows that current, while of so great an influence in changing the complex of the fauna, nevertheless is not an absolutely decisive factor, but that photosynthesis may affect distribution and makeup in the establishment of a different substratum. To what extent the makeup of the plant substratum is able to affect the faunal composition is indicated by a comparison of the Yahara River, as just described, and Pheasant Branch Creek.

In the latter Lestes forcipatus and other Zgyoptera larvae abound. Hyalellae are few, Setodes grandis scarce, beetle larvae plentiful, Culicidae rare, Nymphula larvae numerous; while in the Yahara River these faunal proportions are exactly the converse.

Ponds.—It is a curious circumstance, that to a considerable extent the fauna of Pheasant Branch Creek and Picnic Pond have much in common. But while Pheasant Branch Creek has a strong current, Picnic Pond is stagnant, being maintained by seepage from the lake. Lepidoptera larvae, beetle larvae of various kinds, except Gyrinidae, Chironomidae, Lestes, Sympetrum, and Libellula basalis among Odonata, and other species, are common to both regions. As for differences, Corethra is common in the pond (recruited from the lake); so are Culicidae larvae, Dytiscidae, Cyphonidae, Tipulidae, Stratiomyidae, Ephydridae, and certain other forms which are more or less limited in their distribution.

Again, Tenney Park contains a large lagoon and a small pond. The lagoon contains flowing water, supplied from the lake, and its fauna is that of a stream. But the pond, small as it is (10 m. diameter) is noted as a depository of toad eggs, and harbors several faunal forms which agree with those of Picnic Pond, while

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differing in its larger representation of certain Dytiscidae and Anisoptera.

The character of the ponds therefore appear to be chiefly stagnancy, shallowness, and the tendency toward swamping. Only the fact that there is open water (generally) in the middle prevents acidification. Circulation is minimal in the vegetation areas, with the tendency toward local centers; that is, little isolated patches of warmer and cooler water. In a swamp such warm patches would soon form decomposition centers, while in ponds the periodical disturbance of the open water in the middle is sufficiently strong to suppress such centers. Yet even in ponds, especially in dry summers, the vegetation may gain the upper hand and cover the entire pond area. In such instances acidification is strong, decomposition advanced, and the remaining water becomes untenable for the major part of the fauna.

Summary of Lake Characters.

It is evident from the brief survey of types of aquatic habitats that the interrelations are comparatively easy to outline and so are the larger differences; but it is extremely difficult to fix the precise points at which differences begin. No habitat can be set forth as a unit which is well-definable in every respect; I have rather attempted to show what might be used as criteria by calling attention to the interrelations. Physical and physiological conditions intergrade everywhere; for the environment is labile. Correspondingly, there is an intergradation of biota; for the organism, too, is labile.

Therefore, in attempting to define a habitat such as the lake the intergradation with surrounding habitats must be kept in mind and not too strict an emphasis laid on any single characteristic. The following is an attempt to define the lake as an aquatic unit, distinct from other aquatic bodies:

The lake is body of water

1. Of sufficient depth and area to permit strong wave action.
2. Without emergent or floating vegetation. This is due to condition number one.
3. With a shore line destitute of plants, except Cladophora, and harboring only clingers and burrowers among animals. A

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result of condition number one. This region shows the greatest specialization among lake animals.

4. Without surface-breathers among animals.

5. With a plant zone of variable depth (according to clearness of the water) which is barely indicated in winter, but luxuriates during summer. Parallel with plant growth a great summer proliferation of phytophagous animals.

6. With a thermal stratification for a portion of the year.

In part, these conditions apply to rapids and spring outlets, especially those pertaining to the fauna. In part, they may also apply to streams. We have, therefore, a gradual merging of lake to pond and swamp in one series, and lake to swamp directly. Rapids, springs, and lakes form the water-breathing associations, while ponds, swamps, and appendant lake shallows form the air-breathing associations, with streams occupying an intermediate position.

From the definition given above it will be seen that the term "lake" for certain bodies of water is inapplicable. At best, the term has been used in a relative sense as applicable to any broad and enclosed expanse of water. Thus, the shallows of streams when spread over large areas have been called lakes, although lacking every true characteristic. Again, the vegetation character is not always distinct. Shallowing of lakes produces "swamping," a feature which is invariably characterized by emergent growth of plants. Yet there are lakes where this shallowing process is so gradual that a breaker line or rachion is barely indicated on the bottom, and the transition from lake to swamp is practically imperceptible.

The absence of surface-breathers is a good characteristic, but is applicable also to the open water of ponds, and rivers, that is, to a large extent. Again, stagnation coupled with the formation of a thermocline may be characteristic of a great many lakes; yet so large a body of water as Lake Vaettern in Sweden has only a very gradual thermocline and the bottom waters contain oxygen the year round.

Hence this definition will be found inadequate for some lakes, and inapplicable for certain others. But for the "plains" lakes it will probably be generally acceptable. Alpine lakes have certain special conditions; but even here the conditions present some similarities.

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In respect to faunal and floral distribution Lakes Mendota, Monona, Waubesa, Cedar, Nagawicka, and most others in southern Wisconsin present a similar situation. Practically all of these lakes have a low degree of transparency and hence have a shallow zone of photosynthesis. All of them have similar types of shore, rough in places, sandy in others, and tending to swamp in less exposed situations. The northern Wisconsin lakes are more transparent and show a correspondingly greater zone of photosynthesis. They are more like the Alpine lakes in this respect.

In its particulate aspects, comparison with other lakes can be only relative. For the littoral areas much the same type of fauna and flora will be found in all lakes, except the very large and stormy lakes. Wesenberg-Lund (1908) finds similar types for the rock shore communities of Danish lakes, although Lake Mendota seems more populous. Forel, Zacharias, Zschokke and others have worked on the fauna of alpine lakes and find a similarly typical fauna as far as the littoral area is concerned.

In the aphytal area the situation differs somewhat. From a physiographical standpoint some of the alpine lakes are valleys between mountains which are filled with water. Some of them have a depth of more than 500 meters, and we find conditions at these depths which are somewhat akin to those of the ocean abyss. In the upper portions of the aphytal area (inappropriately termed "abyssal area") the fauna resembles that of the aphytal area of Lake Mendota. Below 50 meters this resemblance ceases. Practically all of these deep lakes harbor a series of glacial relicts, and certain species of worms, in general, forms that never come to the shallower depths above 50 meters. And as a result there is a fauna, rich in its variety and adaptations, which has been called an abyssal fauna (inappropriately so, as just mentioned, since the term is preoccupied in a special sense in oceanology.)

As far as the plains lakes are concerned, these "abyssal" conditions do not exist in them aside from the general conditions of the aphytal area. Their fauna consists largely of species which come to the surface or at least to the shallower waters at some time during their life. No special fauna has been developed which is particulate in its predilections for great depths. In general, the fauna is such as may be found within relatively shallow waters, a fauna which connects distinctly with that of the shores and shallow bodies of water.

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TABLE 1. *Areas of the Lake at Various Depths*

The difference of the areas is indicated is square meters. Ecological Habitats shown for comparison.

Depth in meters	Area in sq. km.	Difference in sq. m.	Ecological Zone	Ecological Area	
0	39.4		Shore to Rachion	Eulittoral (Euphytal) Area	Littoral Region
1	35.4	4.000 000			
2	33.7	1.700 000			
3	32.0	1.700 000	Plant Zone		
5	29.0	3.000 000			
7	26.5	2.500 000	Shell Zone—	Sublittoral (Dysphatal) Area	
10	24.0	2.500 000	Plantless		
15	16.8	7.200 000	Zone	..... Aphytal Region	
20	6.6	10.200 000			
25.6	0.0	6.600 000			

TABLE 2. *Types of Odonate Larvae*

Habitat Preference	Form	Group	General Habitus	Group	Form	Habitat Preference
			Rock Clingers	Some ZYGOPTERA	Depressed	Petrophilous
Phytophilous	Cylindrical	LESTINAE	Free Swimmers			
			Plant Clingers	ZYGOPTERA	Elongate	Phytophilous
Phytophilous	Lanceolate	AESCHNINAE	Loping Swimmers	LIBELLULIDAE CORDULEGASTERINAE	Squat, Depressed	Benthophilous
Scaptophilous	Very flat	GOMPHINAE PETALURINAE	Sprawlers			
			Burrowers			

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TABLE 3. *Dipterous Families Whose Larvae are Found in Water.*

Family	Terrestial Larvae	Aquatic Larvae		
		Breathers	Water Breathers	
			Lake	Rapids
1. Tipulidae pars	x	x		
2. Ptychopteridae		x		
3. Psychodidae				
Psychoda, Pericoma pars		x		
Pericoma pars, Ulomyia				x
4. Dixidae		x		
5. Culicidae		x		
6. Corethridae				
Mochlonyx		x		
Corethra			x	
7. Chironomidae			x	
Ceratopogoninae pars	x		x	
8. Simulidae				x
9. Blepharoceridae				x
10. Orphnephilidae		x		
11. Leptidae pars	x			
Atherix				x
12. Stratiomyiidae pars	x	x		
13. Tabanidae pars	x	x		
14. Syrphidae		x		
15. Ephydridae		x		
16. Sciomyzidae		x		
17. Cordyluridae pars	x	x		
18. Anthomyiidae pars	x	x		
Calliophrys				x
19. Oestridae (endoparasitic)		x		

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TABLE 4. *Coleoptera and their Relations to Aquatic Life.*

Name	Obtaining air in gaseous form			Obtaining air in solution	
		Aquatic		Water Breathers	
	Terrestial	*Surface-air* come to surface to breathe	*Submerged air* capture gas bubbles	Air passes out of solution in film outside of body and is breathed by spiracles	Air passes out of solution within body
Hygrobiidae					
Larva		x			
Pupa		x			
Adult	x				
Dytiscidae					
Larva		x			
Pupa	x	x			
Adult	x	x	x		
Hydrophilidae					
Larva pars		x			x (Berosi-
Pupae pars		x			x ni)
Adult		x	x		
Donaciinae					
Larva			x*		
Pupa			x*		
Adult	x	x	x		
Haemonia adult				x	
Gyrinidae					
Larva					x
Pupa	x	x			
Adult	x	x	x		
Cyphonidae					
Larva					x
Pupa					x
Adult	x				
Haliplidae					
Larva					x
Pupa					x
Adult		x	x		
Dryopidae					
Stenelmis / Limnius — Larva					x
Stenelmis / Limnius — Pupa	x				
Stenelmis / Limnius — Adult				x	
Psephenus / Elmis / Dryops — Larva					x
Psephenus / Elmis / Dryops — Pupa	x				
Psephenus / Elmis / Dryops — Adult	x	x			

*The Donaciinae live submerged, but obtain their air by sinking the caudal hooks into the air vessels of aquatic plants—hence are indirectly surface-breathers.

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TABLE 5. *Numerical distribution of various forms of animals between the shore line and a depth of 7 meters.*

The averages are computed on a basis of 50 stations for each of the depths given. The total number of individuals of the various forms may be ascertained by multiplying the averages by the areas at the different depths, viz., 0—1 m. = 4 sq. km.; 1–2 m. and 2–3 m. = 1.7 sq. km. each; 3–5 m. = 3 sq. km.; 5–7 = 2.5 sq. km.

Name	Averages per sq. m. at depths of				
	0-1 m:	1-2 m:	2-3 m:	3-5 m:	5-7 m:
Platyhelmia					
Planaria maculata	64.00	3.77	8.97	54.10	18.50
Polycelis nigra	0.26	.....	.....	.....	.....
Dendrocoelium lacteum	0.26	.....	.....	.....	.....
Mesostoma ehrenbergii	.....	.....	0.13	.....	.....
Nemathelmia					
Gordius aquaticus	2.33	0.35	0.92	.....	.....
Pink Nematode	0.95	.....	0.07	.....	.....
Chaetopoda					
Small Oligochaeta	169.00	267.00	637.00	1560.00	610.00
Sparganophilus eiseni	0.44	.....	.....	.....	.....
Lumbriculus limosa	3 11	0.66	3.55	0.21	0.13
Lumbriculid sp	.....	.....	0.22	.....	.....
Tubifex tubifex	2.88	9.55	8.00	.....	.....
Limnodrilus claparedianus	.....	0.33	0.44	.....	10.00
Hirudinea					
Leeches	11.2	1.93	0.75	14.0	0.25
Mollusca					
Amnicola limosa	2.21	118.00	168.7	200.00	129.00
Ancylus	.....	0.06	0.26	.....	.....
Limnaea stagnalis	2.44	0.91	0.55	1.00	1.50
Physa ancillaris	0.11	1.05	2.00	.....	.....
Physa heterostropha	2.66	0.11	0.40	.....	.....
Physa gyrina	4.57	3.13	60.60	14 60	11.40
Planorbis bicarinatus	2.84	0.77	3.82	33.40	75.40
Planorbis campanulatus	1.97	0.68	1.77	5.00	21.70
Planorbis parvus	3.57	9.11	4.77	15.20	33.70
Pleurocera elevatum	0.40	1.02	1.00	1.65	1.25
Campeloma	0 22	0.55	0.33	4.56	20.50
Valvata tricarinata	0.06	1.86	3.62	.....	0.15
Sphaerium	1.13	2.54	1.73	3.47	3.80
Anodonta & Lampsilis	.....	0.13	0.13	0.04	1.35
Corneocyclas	.....	.....	.....	.....	19.50
Crustacea					
Dikerogammarus fasciatus	22.9	.....	0.6	.....	.....
Hyalella azteca	150.4	76.7	88.5	286.5	82.7
Cambarus propinquus	1.37	.....	.....	.....	.....
Hydrachnida					
Atacinae	2.28	12.6	15.60	3.04	.....
Arrhenurinae	8.64	12.8	20.6	20.6	13.2
Pioninae	4.64	4.0	11.5	2.13	0.5
Lebertiinae	0.1	0.97	2.28	.....	.....
Limnesiinae	30.9	48.7	50.3	37.0	20.7

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TABLE 5— *Continued.*

Name	Averages per sq. m. at depths of				
	0-1 m.	1-2 m.	2-3 m.	3-5 m.	5-7 m.
Ephemeridae					
Baetisca sp.	1.17	1.26	1.22	0.60	0.25
Caenis diminuta	15.5	5.91	2.51	14.7	6.50
Siphlurus alternatus	0.13	0.08			
Ecdyurus maculipennis	16.2	0.26			
Heptagenia interpunctata	7.33	0.13			
Heptagenia canadensis				0.08	0.10
Ephemera varia	0.15	0.53	0.62		0.10
Odonata					
Argia putrida	0.11				
Ischnura verticalis	0.33	0.85			
Enallagma antennatum	1.11	0.42	1.87	0.62	
Gomphus fraternus	0.20	0.20			
Epicordulia princeps	0.04	0.2	0.11	0.04	
Hemiptera					
Corixa sp.	3.40	0.33			
Pelocoris femoratus	0.13	0.4			
Notonecta glauca	0.22				
Plea striola	2.44	0.86	0.33		
Sialidae					
Sialis infumata					4.9
Trichoptera					
Agraylea multipunctata	27.67	45.20	14.64	10.87	
Hydroptila sp.	54.60	63.60	18.80	3.26	
Ithytrichia clavata	23.00		0.11		
Oxyethira sp.	0.13		0.06		
Leptocella uwarowii	69.82	60.97	83.70	65.00	11.55
Helicopsyche borealis	16.65	9.04	13.87	3.74	0.80
Leptocerus ancylus	2.90				
Leptocerus dilutus	0.65		0.09		
Leptocerus sp.			0.06	1.30	4.55
Molanna uniophila	1.46	0.53	0.91	0.26	
Polycentropus sp.	0.17		0.09		
Platyphylax subfasciatus	0.06	0.10			
Triaenodes flavescens			0.22	0.08	0.45
Limnephilus sp.	0.55	0.11	0.04		0.15
Corethridae					
Corethra punctipennis	1.33	0.22	0.22		10.50
Chironomidae					
Palpomyia longipennis	1.06	0.48	0.26		
Probezzia pallida	2.28	1.95	0.24		
P. glaber	6.66	45.50	13.9	5.91	1.25
Protenthes choreus			1.55		*24.00
Tanypus monilis	1.53	5.53	8.88	14.90	
T. fasciatus		10.00	0.06		
Chironomus abbreviatus			1.55		
C. tentans			0.22	4.34	15.0
C. digitatus	46.00	49.20	21.50	5.65	0.25
C. flavus		0.17		0.21	
C. fulviventris		0.66	0.06		3.50
C. lobiferus	26.60	32.03	35.50	48.00	19.00
C. modestus	0.66		0.11		
C. plumosus	2.06	0.22			
C. tentans var. ?	1.88	3.44	1.55	1.52	4.00
C. viridis		2.11	9.70	60.60	21.00
Tanytarsus exiguus					9.00
Cricotopus trifasciatus	9.06	4.99	8.89	3.04	
C. exilis	0.66				
Coleoptera					
Bidessus flavicollis ad.	1.2		0.8		
Coptotomus interrogatus ad.	0.15		0.04		
Hydroporus undulatus ad.	0.55				
Laccophilus maculatus ad.	0.02				
Peltodytes edentulus ad.	0.28				
P. edentulus larv.	0.20				

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TABLE 5—Continued.

Name	Average per sq. m. at depth of				
	0-1m.	1-2m.	2-3 m.	3-5 m.	5-7 m.
P. 12-punctatus ad.	0.22	.....	.....	.....	.....
Haliplus ruficollis adult.	0.53	.....	.....	.....	.....
H. ruficollis larv.	0.13	0.15	.....	.....	.....
Dryops lithophilus adult.	0.08	.....	0.11	.....	.....
Stenelmis crenatus ad.	0.95	0.02	.....	0.08	0.75
S. crenatus larva	12.9	0.22	0.08	0.34	.....
Elmis vittatus ad.	0.04	.....	.....	0.08	.....
Parnid larva (trilobitic)	1.22	.....	.....	.....	.....
Psephenus lecontei ad.	0.57	.....	.....	.....	.....
P. lecontei larva	28.3	0.44	0.06	.....	.....

TABLE 6

Estimates of the total number of individuals of the various groups of animals between the shore line and 7 meters, based on the averages obtained from the 50 different stations.

Platyhelmia	553,200,000
Nemathelmia	18,600,000
Chaetopoda	8,690,500,000
Hirudinea	103,200,000
Mollusca	2,389,700,000
Crustacea	2,221,300,000
Hydrachnida	815,900,000
Ephemeridae	291,300,000
Odonata	16,400,000
Hemiptera	49,300,000
Sialidae	12,200,000
Trichoptera	1,862,800,000
Corethridae	38,900,000
Chironomidae	2,644,700,000
Coleoptera	218,400,000

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TABLE 7.—*Showing Distribution by Depth and Character of Bottom*

(Abbreviations: r = rare; f = frequent; a = abundant; c = common)
(R = Rock bottom; G = Gravel; S = Sand; M = Mud; P = Plant).
(See p. 419)

NAME	DEPTH IN METERS						CHARACTER OF BOTTOM:					OPTIMUM	
	0-1	1-2	2-3	3-5	5-7	7-	Rock	Gravel	Sand	Mud	Plant	Opt. depth	Opt. Hab.
COELENTERATA													
Hydra fusca	r	c	cc	c	a	f	.....	.....	.....	f	ccc	2-3	P
PORIFERA													
Euspongia officinalis	c	.....	.....	.....	.....	.....	c	.....	.....	.....	.....	0-1	R
BRYOZOA													
Plumatella repens	a	.....	.....	.....	.....	.....	a	.....	.....	.....	.....	0-1	R
PLATYHELMIA													
Polycelis nigra	f	.....	.....	.....	.....	.....	a	.....	.....	.....	.....	0-1	R
Dendrocoelium lacteum	f	.....	.....	.....	.....	.....	a	.....	.....	.....	.....	0-1	R
Planaria maculata	c	c	cc	cc	c	a	cc	c	f	f	ccc	2-5	P
Mesostomum ehrenbergi	.....	.....	f	.....	..	.....	.....	.....	.....	f	*f*	3	PM
NEMATHELMIA													
Gordius aquaticus	a	a	a	.....	.....	.....	f	f	.....	*a*	.....	1-25	M
Pink Nematode	a	f	f	.....	.....	.....	f	f	.....	*a*	.....	1-25	M
ANNELIDA													
Sparganophilus eiseni	c	f	.....	.....	.....	.....	.....	c	r	.....	.....	0-1	G
Lumbriculid sp.	c	c	c	c	f	.....	.....	.....	f	*a*	.....	.....	.....
Small Oligochaeta	cc	ccc	ccc	ccc	ccc	cc	a	a	.....	a	ccc	2-6	P
Lumbriculus limosa	a	a	c	c	a	a	.....	r	f	c	...	2-5	SM
Tubifex tubifex	f	a	c	c	cc	cc	.....	.....	c	ccc	.....	7-25	M
Limnodrilus clapare-dianus	.....	r	r	a	c	cc	.....	.....	r	ccc	....	7-25	M
HIRUDINEA spp.	cc	a	a	c	a	f	ccc	c	r	r	cc	1-5	RP
MOLLUSCA													
Amnicola limosa	a	cc	cc	cc	cc	c	a	c	cc	c	cc	1-4	SP
Physa heterostropha	f	*a*	r	.....	.....	.....	.....	.....	f	.....	.....	1-2	S
Physa ancillaris	r	f	*a*	.....	.....	.....	.....	.....	f	f	.....	2-3	SM
Valvata tricarinata	r	f	c	f	f	r	.....	.....	r	r	.....	2-3	S
Anodonta & Lampsilis	f	f	*a*	a	r	r	.....	.....	*f*	r	.....	2-3	S
Sphaerium occidentalis	f	c	c	c	c	f	f	a	c	a	.....	2-3	S
Ancylus	r	f	*f*	f	f	.....	r	r	r	*a*	.....	2-5	M
Physa gyrina	f	f	cc	c	c	c	.....	.....	f	*a*	.....	2-6	SM
Pleurocera elevatum	r	f	f	*f*	f	f	.....	.....	f	.....	.....	3-5	S
Campeloma	r	r	r	a	*c*	c	.....	.....	f	f	.....	5-9	M
Planorbis parvus	f	a	a	c	c	c	r	.....	a	a	cc	4-7	P
Planorbis campanulatus	r	r	r	r	c	c	.....	a	f	f	f	4-9	SMP
Planorbis bicarinatus	f	r	f	c	cc	c	.....	.....	a	a	a	4-9	SMP
Limnaea stagnalis	r	r	r	f	*a*	*a*	.....	.....	f	a	f	4-12	SMP
Corneocyclas	.....	.....	.....	.....	c	ccc	.....	.....	.....	ccc	.....	6-25	M
CRUSTACEA													
Dikerogammarus fas-ciatus	cc	r	r	.....	.....	.....	cc	.....	.....	.....	.....	0-1	R
Cambarus propinquus	*a*	f	r	.....	.....	.....	a	*a*	r	.....	.....	0-2	G
Hyalella azteca	ccc	c	cc	ccc	cc	c	ccc	c	f	r	ccc	1,2-7	RP
HYDRACHNIDA													
Atacinae	r	a	c	a	f	f	a	a	a	a	cc	2-6	P
Arrhenurinae	a	c	cc	c	f	f	a	a	a	a	cc	2-6	P
Lebertiinae	r	r	*a*	r	r	r	r	r	r	r	*a*	2-6	P
Pioninae	f	f	c	f	f	f	a	a	a	a	cc	2-6	P
Limnesiinae	cc	cc	cc	cc	cc	cc	c	c	c	c	ccc	0-15	PM
EPHEMERIDA													
Siphlurus alternatus	*r*	r	.....	.....	.....	.....	r	.....	.....	.....	.....	0-1	R
Ecdyurus maculipennis	cc	r	.....	.....	.....	.....	cc	a	.....	.....	.....	0-1	R

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TABLE 7.— *Showing Distribution by Depth and Character of Bottom.*—(Continued.)

NAME	DEPTH IN METERS						CHARACTER OF BOTTOM:					OPTIMUM	
	0-1	1-2	2-3	3-5	5-7	7-	Rock	Gravel	Sand	Mud	Plant	Opt. dept.	Opt. Hab
EPHEMERIDA—(Cont.)													
Heptagenia interpunctata	cc	r	.....	.....	.....	.....	cc	a	.....	.....	.....	0-1	R
Baetisca sp.	a	f	f	f	r	r	c	.....	.....	.....	c	1	RP
Ephemera varia yg. lar.	r	a	c	.....	.....	.....	f	a	c	.....	.....	1-3	S
" " old "	c	a	r	.....	.....	.....	a	c	r	.....	.....	0-2	GR
Heptagenia canadensis.	.....	.....	.....	f	f	f	a	.....	.....	.....	.....	5-10	R
Caenis diminuta	c	c	c	cc	c	a	c	a	r	.....	ccc	1, 5-9	P
ODONATA													
Argia putrida	f	.....	.....	.....	.....	.....	f	f	.....	..	.....	0-2	RG
Ischnura verticalis	f	f	.....	.....	.....	.....	f	r	.....	.....	a	1-3	P
Gomphus fraternus	r	r	.....	.....	.....	.....	r	r	r	.....	...	1	SG
Enallagma antennatum	f	r	f	r	.....	.....	.....	.....	.....	.....	a	2-4	P
Epicordulia princeps	r	r	r	r	r	.....	r	f	f	.....	.....	2-7	SG
HEMIPTERA													
Notonecta glauca	r	.....	.....	.....	.....	.....	f	.....	.....	.....	.....	.....	
Corixa sp	a	r	.....	.....	.....	.....	f	.....	.....	.....	.....	.....	
Plea striola	c	r	r	.....	.....	.....	f	.....	.....	.....	.....	.....	
NEUROPTERA													
Sisyra umbrata	f	.....	.....	.....	.....	.....	f	.....	.....	.....	.....	0-1	R
Sialis infumata	.....	.....	.....	r	a	cc	.....	.....	.....	c	.....	6-25	M
LEPIDOPTERA													
Nymphula maculalis	f	f	.....	.....	.....	.....	.....	.....	.....	.....	a	1	P
Nymphula allionalis	f	f	.....	.....	.....	.....	.....	.....	.....	.....	a	1	P
TRICHOPTERA													
Leptocerus ancylus	a	r	.....	.....	.....	.....	a	r	.....	.....	.....	0-1	R
Leptocerus dilutus	a	r	.....	.....	.....	.....	a	r	.....	.....	.....	0-1	R
Polycentropus sp.	c	r	.....	.....	.....	.....	c	c	.....	.....	.....	0-2	RG
Ithytrichia clavata	cc	r	r	.....	.....	.....	cc	c	.....	.....	c	0-1	RG
Oxyethira sp	r	.....	.....	.....	.....	.....	.....	.....	.....	.....	r	1	P
Limnephilus sp	a	f	f	f	f	r	f	f	.....	.....	f	0-2	P
Platyphylax subfasciatus	.....	f	r	.....	.....	.....	r	.....	f	.....	f	0-2	PS
Agraylea multipunctata	cc	ccc	cc	c	c	f	cc	c	f	.....	ccc	0-4	RP
Hydroptila sp	ccc	ccc	cc	c	c	f	cc	c	c	.....	cc	0-5	RP
Molanna uniophila	a	c	a	a	f	r	f	a	c	.....	.....	1	SG
Leptocella uwarowii	ccc	ccc	ccc	ccc	cc	c	c	a	a	.....	ccc	0-7	P
Helicopsyche borealis	c	c	c	a	f	r	f	r	c	.....	.....	0-5	S
Triaenodes flavescens	r	r	r	f	f	r	.....	.....	.....	.....	a	2-6	P
Leptocerus sp	.....	.....	r	r	f	c	.....	.....	f	c	.....	5-12	M
DIPTERA													
Corethra punctipennis	.....	.....	.....	r	c	ccc	.....	.....	.....	cc	.....	7-25	M
Palpomyia longipennis	a	f	f	r	r	r	a	r	.....	r	c	0-2	PR
Probezzia pallida	c	a	f	f	r	r	a	r	.....	r	c	0-2	PR
Chironomus modestus	r	r	r	.....	.....	.....	.....	.....	r	.....	r	0-2	S
Chironomus plumosus	a	r	r	.....	.....	.....	a	a	c	.....	.....	0-2	S
Cricotopus exilis	r	.....	.....	.....	.....	.....	.....	.....	.....	.....	r	0-1	P
Cricotopus trifasciatus	a	a	a	f	r	.....	.....	a	a	.....	f	0-3	S
Chironomus tentans var	a	c	a	f	f	f	f	c	c	....	r	0-3	S
Chironomus digitatus	cc	cc	cc	c	a	f	c	cc	ccc	f	c	0-5	S
Chironomus lobiferus	cc	cc	cc	cc	c	a	c	cc	ccc	a	ccc	0-12	SP
Probezzia glaber	c	cc	cc	c	a	f	a	a	a	.....	cc	0-5	P
Chironomus fulviventris	f	f	f	f	.....	.....	.....	.....	f	.....	.....	0-3	S
Chironomus flavus	.....	f	.....	.....	.....	.....	.....	.....	f	.....	.....	2	S
Tanypus fasciatus	.....	c	a	f	.....	.....	.....	.....	a	.....	.....	2	S
Chironomus viridis	.....	a	c	ccc	cc	a	.....	.....	c	.....	ccc	2-6	P
Tanypus monilis	f	a	c	cc	c	a	.....	.....	c	a	cc	3-6	PS
Chironomus abbreviatus	.....	.....	f	.....	.....	.....	.....	.....	f	.....	.....	3	S
Tanytarsus exiguus	.....	.....	.....	.....	a	.....	.....	.....	a	.....	.....	5-7	S
Protenthes choreus	.....	.....	f	f	c	cc	.....	.....	a	cc	.....	7-25	M
Chironomus tentans	f	f	f	a	c	cc	.....	.....	f	cc	.....	7-25	M

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TABLE 7.—*Showing Distribution by Depth and Character of Bottom*

NAME	DEPTH IN METERS						CHAHACTER OF BOTTOM:					OPTIMUM	
	0-1	1-2	2-3	3-5	5-7	7-	Rock	Gravel	Sand	Mud	Plant	Opt. depth	Opt. Hab.
COLEOPTERA													
Dytiscus sp. larva	r	.....	.....	.....	.....	.....	.....	r	.....	.....	.....	0-1	G
Hydroporus undulatus adult	r	.....	.....	.....	.....	.....	.....	r	.....	.....	.....	0-1	G
Laccophilus maculatus adult	r	.....	.....	.....	.....	.....	.....	r	.....	.....	.....	0-1	G
Peltodytes edentulus adult	r	....	.....	.....	.....	.....	.....	r	.....	.....	.....	0-1	G
" larva	r	r	.....	.....	.....	....	.....	r	.....	.....	.....	0-2	G
Peltodytes duodecim-punctatus adult	r	.....	.....	.....	.....	.....	.....	r	.....	.....	.....	0-1	G
Haliplus ruficollis ad...	f	.....	.....	.....	.....	.....	... .	f	.....	.....	.....	0-1	G
Agabus sp. adult	r	.....	.....	.....	... .	.....	r	.....	.....	.....	.....	0-1	R
Psephenus lecontei ad ..	r	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Parnid larva	f	f	.....	.....	.....	.....	f	r	.. ..	.....	... .	1	R
Haliplus ruficollis larva	r	r	*f*	r	r	r	.....	.....	r	... .	f	2-4	P
Dryops lithophilus ad...	r	r	r	r	.....	.....	r	r	r	.....	.....	0-2	RG
Elmis vittatus adult	r	r	r	*f*	r	r	r	r	r	.....	.....	3-6	SG
Psephenus lecontei larva	cc	f	r	r	r	.....	c	a	.....	.....	.....	0-1	R
Stenelmis crenatus larva	cc	a	f	r	r	.....	c	cc	r	.....	.....	0-1	G
adult	f	*f*	*f*	f	f	r	f	f	f	... .	f	1-3	SP

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TABLE 8.—*Ecological Distribution of Lake Animals Arranged in the Order of their Habitats.*

(Abbreviations: a = abundant; c = common; f = frequent; r = rare.)

(See p. 432)

	1. Shore Line			2. Rachion	3. Vegetation			4. Shell zone	5. Aphytal zone
	Rock	Gravel	Sand		Upright	Recumbent	Bottom		
ROCKY SHORE									
Spongilla fragilis	c								
Plumatella repens	c				a				
Dendrocoelium lacteum	c	a		a					
Polycelis nigra	c	a		a					
Erpobdella punctata	c	a		a					
Nephelopsis obscura	c	a		a					
Dikerogammarus fasciatus	c	a		a					
Hyalella azteca	cc	c	a	c	cc	c	a		
Siphlurus alternatus	a	f		f					
Ecdyurus maculipennis	cc	a		c					
Heptagenia interpunctata	cc	a		c					
Baetisca sp.	c			a	c				
Sisyra umbrata	a								
Leptocerus ancylus	c	a		a					
Leptocerus dilutus	c	a		f					
Polycentropus sp.	c	a		c					
Ithytrichia clavata	cc	c		c	r				
Hydroptila sp.	cc	c		c	c	c	c		
Agrayles multipunctata	cc	c		c	cc	c	a		
Palpomyia longipennis	c	r		a	a	a	r	r	
Probezzia pallida	c	a		a	c	a	r	r	
Chironomus lobiferus	c	a	a	c	c	c	c	a	a
Parnid sp. larva	c	a		a					
Psephenus lecontei larva	cc	c		c					
GRAVEL SHORE									
Sparganophilus eiseni	a	c	a	a					
Amnicola limosa	a	c	a	c	cc	c	cc	c	
Cambarus propinquus	a	c	r	c			r		
Ephemera varia yg. larva			r	a				c	
Ephemera varia old larva	c	c		a				f	
Argia putrida	a	a		a					
Chironomus digitatus	c	cc	c	cc	c	c	cc		
Stenelmis crenatus lv.	c	cc		c			f		
RACHION									
Epicordulia princeps			r	a					
Gomphus fraternus			r	a					
Molanna uniophila			r	c			a		
UPRIGHT VEGETATION									
Hydra fusca					cc	c			
Planaria maculata	c	c		c	cc	cc	c	a	
Small Oligochaeta	a	a	a	c	ccc	ccc	cc	c	a
Hirudinea	a	a	r	a	c	c	a	f	
Campeloma					c	c	a	a	
Planorbis parvus	a	a		c	cc	cc	cc	cc	
Pl. campanulatus				a	c	c	c	c	
Pl. bicarinatus				a	c	c	c	c	
Hydrachnida sp.	c	c	a	c	cc	cc	cc	cc	c
Caenis diminuta	a	a		c	cc	cc	c	a	
Ischnura verticalis	f	f		a	c	f			
Enallagma antennatum	r	r		a	a	a			
Nymphula sp.					a	f			
Platyphylax subfasciatus					a	f	r		
Leptocella uwarowii	c	c	a	cc	ccc	cc	c		
Triaenodes flavescens					c	c			
Probezzia glaber	c	c	a	c	cc	cc	a	a	f

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TABLE 8.—*Ecological Distribution of Lake Animals Arranged in the Order of their Habitats*—Continued.

(Abbreviations: a = abundant; c = common; f = frequent; r = rare.)

	1. Shore Line			2. Rachion	3. Vegetation			4. Shell zone	5. Aphytal zone
	Rock	Gravel	Sand		Upright	Recumbent	Bottom		
UPRIGHT VEGETATION—Contin.									
Cricotopus exilis	.....	.....	.....	.....	a	.....	.....	.....	.....
Chironomus viridis	.....	.....	.....	a	cc	c	a	.....	.....
C. palliatus	.....	.....	.....	.....	a	a	r	.....	.....
Tanypus monilis	.....	.....	.....	.....	cc	cc	c	a	.....
RECUMBENT VEGETATION									
Peltodytes edentulus lv	.....	.....	.....	.....	f	c	.....	.....	.....
Berosus sp larva	.....	.....	.....	.....	.....	f	.....	.....	.....
Haliplus ruficollis lv	.....	.....	.....	.....	a	a	.....	.....	.....
Mesostoma ehrenbergii	..	.....	.....	.....	.....	a	f	.....	.....
BARRENS AND BOTTOMS									
Helicopsyche borealis	r	r	.....	a	f	f	cc	.....	.....
Chironomus modestus	.....	.....	.....	.....	.....	.....	c	.....	.....
C. plumosus	a	c	a	c	.....	.....	c	.....	.....
C. tentans var	a	c	c	c	.....	.....	cc	.....	.....
C. fulviventris	f	a	a	a	.....	.....	c	.....	.....
C. flavus	.....	.....	f	f	.....	.....	a	.....	.....
C. abbreviatus	.....	.....	.....	.....	.....	.....	c	.....	.....
Cricotopus trifasciatus	f	f	a	.....	.. ..	.....	c	.....	.....
Tanypus fasciatus	.....	.....	f	.....	... .	.....	a	.....	.....
Stenelmis crenatus ad	a	a	a	c	a	a	c	.....	.....
Gordius aquaticus	.....	.....	.....	.....	.....	.....	c	c	c
Pink Nematode	.....	.....	.....	.....	.....	.....	a	a	a
Lumbriculid sp	.....	.....	f	.....	.....	.....	c	c	r
Lumbriculus limosa	.....	.....	f	f	.....	.....	c	c	r
Physa heterostropha	f	f	.....	f	f	f	c	c	.....
P. ancillaris	.....	.....	.....	.....	a	a	c	c	.....
Valvata tricarinata	.....	.....	.....	.....	.....	.....	a	a	.....
Anodonta & Lampsilis	.....	.....	.....	.....	.....	.....	a	.....	.....
Sphaerium occidentale	f	f	f	f	.....	...	c	c	.....
Ancylus	.....	.....	.....	.....	.....	.....	a	a	.....
Physa gyrina	.....	.....	.....	a	a	a	c	c	.....
Pleurocera elevatum	....	.....	.....	.....	.....	... .	a	a	.....
SHELL ZONE									
Limnaea stagnalis	.....	.....	.....	.....	.....	.....	c	cc	.....
Sialis infumata	.....	.....	.....	.....	.....	.....	a	ccc	cc
Leptocerus sp	.....	.....	.....	.....	.....	.....	a	c	.....
APHYTAL AREA									
Limnodrilus claparedeianus	. ...	.....	.....	.....	.....	.....	c	cc	ccc
Tubifex tubifex	.....	.....	.....	.....	.....	.....	c	cc	ccc
Corneocyclas idahoensis	.....	.....	.....	.....	.....	.....	f	c	ccc
Protenthes choreus	...	.....	.....	.....	.....	.....	c	cc	ccc
Chironomus tentans	.....	.....	.....	.....	.....	.....	c	cc	ccc
Corethra punctipennis	.....	.....	.....	.....	.....	.....	c	cc	ccc

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TABLE 9.—*Comparative Places of the Macrofauna of Lake Mendota.*

Expressed in percentages of bulk (= 100%).

Name	Seasonal (litt)		Annual Estimate	Type of food eaten
	May-July	Aug.-Sept.	Littoral	
Sponges	0.5	0.5	0.5	Microphaga
Bryoza	0.5	0.5	0.5	Microphaga
Annelida	5.0	3.0	2.0	Microphaga, Scavengers
Small Oligochaeta	2.0	15.0	10.0	Microphaga
Hirudinea	4.0	3.0	3.0	Microphaga, blood
Gastropoda	18.0	13.0	15.0	Carnivores, Scavengers
Lamellibranchia	1.0	2.0	1.5	Carnivores, Scavengers
Crustacea	12.0	10.0	8.0	Carnivores, Scavengers
Hydrachnida	1.0	6.0	3.0	Carnivores, parasites, Cannibals
Odonata	2.0	0.5	1.0	Carnivores
Ephemerida	4.0	3.0	3.0	Microphaga, carnivores
Plecoptera	1.0	0.0	0.5	Carnivores
Hemiptera	1.0	1.0	1.0	Carnivores
Neuroptera	2.0	1.0	1.0	Carnivores, Necrophagous
Trichoptera				
Case-builders	5.0	25.0	32.0	Phytophagous, Microphaga
Hydroptilids	15.0	1.0		Phytophaga
Lepidoptera	0.0	0.5	0.5	Phytophaga
Corethridae	5.0	0.0	0.5	Carnivores, microphaga, Scavengers
Chironomidae	18.0	14.0	16.0	Carnivores, microphaga cannibals, scavengers
Coleoptera	2.0	1.0	1.0	Microphaga, or phytophaga, or carnivora
Fish	.....	.....	.....	Microphaga, Carnivores

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NOTES ON THE VERTEBRATE FAUNA OF HOUGHTON AND IRON COUNTIES, MICHIGAN.

ALVIN R. CAHN.

During the month of August, 1914, the writer spent approximately three weeks in Iron and Houghton counties, in the western third of the northern peninsula of Michigan. Headquarters were made at two places—Kenton, a town in the southwestern corner of Houghton county, and a field camp on the shores of a lake known locally as Lake 33, lying in Iron county some fifteen miles from Kenton. These two stations, so very different in character, yielded a variety of animals that may perhaps be considered as typical of the interior of northern Michigan.

Kenton is the site of what was once a bustling lumber camp, the brain, as it were, from which impulses were sent into the heart of the vast pine (*Pinus strobus*) forests, stretching away in every direction. The result of these impulses are today the feature of the landscape. As far as the eye can reach, undulating hills are dotted with stubs twelve to eighteen inches high, thickly interspersed with the needle-like shafts of dead pine "saplings" which were left, alive, at the time the timber cuttings were made, but which died probably from the excessive exposure. Fire and wind have also played their part in the denudation of the landscape, and great tangled "slashings" are found bisecting the forests. Here and there are large areas of "second growth", fighting for every inch of ground, every drop of moisture, every ray of sun-light. Some of this "second growth" has already reached a considerable size, but much of it is the growth of the last fifteen to twenty-five years. A river of rust-colored water, the Kenton river,—the east branch of the Ontonagon,—flows around the edge of the town, winding alternately through clearings and dense woods. Animal life abounds in this

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region, and, as might well be expected, the birds are both the most numerous and most in evidence of the vertebrates. In the open areas hawks are found in great abundance, particularly the sparrow hawk, with an occasional sharp-shinned hawk perched conspicuously on a dead limb, while high over head the circling red-tail may be heard. In the greener "second-growth" regions ruffed grouse abound in extraordinary numbers, and a lone woodcock may upon a rare occasion be flushed from some wet thicket. The river attracts its share of the acquatic birds, and red-breasted mergansers and mallards are to be found feeding among the overhanging vegetation, while sandpipers investigate the stony beaches.

Lake 33 lies in the heart of a very thick "second growth" pine (*Pinus strobus* and *P. resinosa*) of about twenty-five or more years stand. Once beyond the clearing of Kenton, the trip to the lake is made through seemingly endless forest, amid a silence broken only by the sudden whirr of a partridge, the sweet song of the white-throat, the "dee dee dee" of flocks of chickadees, or the distant hammering of the "cock-o'-the-woods"—the northern pileated woodpecker. The path opens before, and closes behind, while overhead the branches of the dense trees interlock so closely that only occasionally the blue of the sky may be seen, giving to one who is not accustomed to the silence of the north woods the sensation of absolute solitude,—which is, in fact, a reality. Lake 33 is the largest lake visited by the writer, and is approximately two and one half miles long and one mile wide. Beyond it on all sides lie lakes of various sizes, shapes, and depths, each set in its little valley, and hemmed in by a sphagnum bog, beyond which rises the encircling, silent, uncompromising forest. These lakes are for the most part unconnected during the greater portion of the year, and all abound in fish life—pike *(Esox lucius)*, perch *(Perca flavescens)*, blue-gills *(Lepomis pallidus)*, and shiners *(Notropis cornutus)*, which evidently attract the numerous water birds found.

The northern peninsula of Michigan is still a fertile field for the zoologist, and there is a vast amount of collecting and observing to be done before anything can be published that will savor of a complete catalogue of its fauna. However, it is perhaps advisable that a beginning be made. The present paper adds the following number of species to the published records

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EAST BRANCH OF THE ONTONAGON RIVER ABOVE KENTON

COCKAYNE, BOSTON

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EAST BRANCH OF THE ONTONAGON RIVER AT KENTON

COCKAYNE, BOSTON

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of C. and H. Thompson (1)*, Ruthven (2), Blackwelder (3), and Wood (4):

Amphibia	13	species.
Reptilia	6	"
Aves	23	"
Mammalia	28	"
Total	70	"

Obviously, neither time nor opportunity permitted a complete or thorough investigation of the vertebrate fauna of those parts of the two counties visited, and it was impossible for the writer to undertake a collection of the invertebrate fauna. The writer regrets that the lack of adequate nets in the field necessitates the omitting of a list of the fishes of the region. The lakes teem with fish, and a collection from the different lakes and streams would no doubt yield many interesting facts.

In the following pages the vertebrate animals of Houghton and Iron counties are discussed. In a few cases species recorded by previous authors are listed, though not found by the present writer. This has been done with the idea of making the lists as complete as possible, and note is made in every instance of the kind. The writer wishes to express his sincere appreciation of the kindness of Dr. and Mrs. Carl Moll, and Mr. Arthur M. Moll of Kenton, through whose invitation, and by whose courtesy he was able to visit the territory covered.

AMPHIBIA.

Mud Puppy. *Necturus maculosus* Rafinesque.

A single dead specimen found on the shores of Lake 33 is the only evidence of the species seen.

Red-backed Salamander. *Plethodon erythronotus* (Green).

Two specimens were collected in the woods of Iron county, under the loose bark of decaying logs.

Newt. *Diemictylus viridescens* Rafinesque.

Five specimens were seen, though but a single one was caught,

*Figures in parenthesis refer to corresponding title in bibliography.

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all in Iron county. A small stream fed into Lake 33, and it was in the deeper parts of this—10 to 12 inches—that all were seen. The one collected had eaten four beetles (*Dytiscus* sp.) as well as several isopods. Reported from Houghton county (1).

American Toad. *Bufo americanus* Le Conte.

Found quite commonly in both counties, though more were seen in Houghton than in Iron—probably because the localities visited were better suited to them. Of local distribution only, apparently being limited to the more open fields and underbrush, as none were found in the dense woods.

Tree Frog. *Hyla versicolor* Le Conte.

Several were seen around Kenton, both on the houses and on the stubs of trees not in the clearings. In the Lake 33 region, a single individual was found, perched on one of the ropes of the tent. This fellow had eaten nothing but flies, two species of *Musca* and one *Syrphus* being noted.

Spring Peeper. *Hyla pickeringii* Holbrook.

Fairly common in Iron county, where they were found along the shores of the smaller lakes, provided that a sufficient quantity of vegetation was present. Two were examined for food, and the stomachs were found to contain the remains of small-sized amphipods (possibly *Hylella*), and some small worms. In Houghton county, a single specimen was collected in the Kenton river riding on top of a small piece of wood.

Swamp Tree Frog. *Chorophilus nigritus* (Le Conte).

Three individuals of this species were collected in Iron county, and none were found in Houghton. These three were found within twenty-five feet of each other, in the same stream which *Diemictylus viridescens* was taken. All the stomachs were empty.

Leopard Frog. *Rana pipiens Shreber.*

Very common in both of the counties. Found along the shores of the lakes or streams nearly any place where there are reeds or rushes for their protection, and often in the cut-over fields, especially if they are at all moist.

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PINE FOREST NEAR LAKE 33: THE HOME OF RANA SYLVATICA

COCKAYNE, BOSTON

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Green Frog. *Rana clamitans* Latreille.

Quite abundant in Iron, and common in Houghton county. In the former they are found less often about the larger lakes than around the small ones, while in Houghton county they are found along the streams.

Wood Frog. *Rana cantabrigensis* Baird.

Common in Houghton and abundant in Iron county. Enroute to Lake 33 this species was met with continually in the path leading through the deep woods, and was never found except in the woods. The species is very active and difficult to catch, both because of this activity and the protectiveness of its coloration. Often found several miles from any permanent body of water, and never seen in the immediate vicinity of either lake or stream.

Northern Frog. *Rana septentrionalis* Baird.

Several individuals were found in Iron county, especially about the smaller of the lakes. Search about Lake 33 yielded but one specimen, while the smaller lakes beyond afforded some dozen specimens. With the exception of one Northern frog found in the basin of the spring which afforded the drinking water—some quarter of a mile through dense woods from the lake—the species was seen only in the lakes. Stomach examination of four showed the food to be small aquatic beetles *(Dytiscus* and *Gyrillus)*, and immature aquatic insects as May-fly and damsel-fly nymphs.

SYNOPSIS OF AMPHIBIANS.

Species.	Iron.	Houghton.
Necturus maculosus	*1	—
Plethodon erythronotus	*2	—
Diemictylus viridescens	*5	x
Bufo americanus	*c	*c
Hyla versicolor	*1	*f
Hyla pickeringii	*f	1
Chorophilus nigritus	*f	—
Rana pipiens	c	c
Rana clamitans	*c	c
Rana cantabrigensis	*c	*f
Rana septentrionalis	*f	x

(In the above table: * = new record for county; c = common; f = few; x = reported previously, but not found by the writer.)

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REPTILIA.

Reptiles were but very little in evidence during the writer's stay, and but three species were found. Were it not for the fact that these records are, for the most part new to the counties, the class would be omitted entirely.

Red-bellied Snake. *Storeria occipitomaculata* (Storer).

Reported (2), but not found by the writer.

Garter Snake. *Thamnophis sirtalis* (Linnaeus).

A few individuals of this species were found in both of the counties. In Houghton they were found quite commonly in the cut-over fields, while in Iron they were found in some of the more open places in the woods.

Snapping Turtle. *Chelydra serpentina* (Linnaeus).

Quite common in both counties. Found in the Kenton river about the town, and in several of the lakes in Iron county. None were seen of any considerable size, the largest being in Lake 33 with a carapace about ten inches long.

Painted Turtle. *Chrysemys cinerea* (Bonnaterre).

Two specimens were collected in Lake 33, and one in the Kenton river in Houghton county. It is believed that these are the first records of the species from the Northern peninsula. The identification was kindly verified for the writer by Dr. Ruthven.

Bell's Turtle. *Chrysemys bellii* Gray.

Two well marked specimens of this turtle were taken in one of the little lakes in Iron county. Nothing was seen of it in Houghton county though it very probably exists there, as boys describe a "colored" turtle which might very well be this species.

SYNOPSIS OF REPTILES.

Species.	Iron.	Houghton.
Storeria occipitomaculata	x	x
Thamnophis sirtalis	*f	c
Chelydra serpentina	*c	*f
Chrysemys cinerea	*?	*1
Chrysemys bellii	*?	?

(In the above table: * = new record; c = common; f = few; x = reported perviously, but not found by the writer.)

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SUMMER AVIFAUNA.

Horned Grebe. *Colymbus auritus* Linn.

A single specimen on the Kenton river is the only record the writer has; reported also from Iron county.

Pied-billed grebe. *Podilymbus podiceps* (Linn.)

This is the only member of the grebe family observed. Two individuals only were seen, one on the river at Kenton, the other on Lake 33. From all indications and reports, a regular summer resident, and very likely a breeding species.

Loon. *Gavia immer* (Brünich).

An abundant summer resident on nearly all of the lakes having shores affording possible nesting sites. At Lake 16 a pair was observed followed by its family of two well grown birds. They were all extremely shy, diving as the boat approached, and their whereabouts were carefully concealed until the boat was nearly to the other end of the lake. A single pair to the smaller lakes is the rule, and on the larger lakes seldom more than two pairs at a time. When rising from the smaller lakes it is necessary for the bird to circle the lake as many as five or six times before it has speed enough to clear the encircling inpes.

Herring Gull. *Larus argentatus* Pontoppidan.

A number of individuals were seen at various times over Lake 33, where they were feeding on the large shiners *(Notropis cornutus)* abundant therein.

Merganser. *Mergus americanus* Cassin.

A single mature male flew low over camp at Lake 33 on August 15, this being the only specimen seen.

Red-breasted Merganser. *Mergus serrator* Linn.

A flock of seven was seen on the river at Kenton, where they were swimming rapidly up-stream. Two individuals flew over Lake 33 just after sunset on August 16. Blackwelder gives the bird as a breeding species, but the writer found no evidence of breeding in that portion of the county which he investigated.

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Mallard. *Anas platyrhynchos* Linn.

Several found on Lake 16, and numerous others were seen nearly every evening flying over Lake 33. These evening flights of ducks were always in a northerly direction, with the birds approximately three hundred feet above the water. Few flocks alighted in Lake 33.

Black Duck. *Anas rubripes* Brewster.

More common even than the preceding. Seen on Lake 16, and on the evening flights over Lake 33. These birds were wild in the extreme, a single shot from any point on the lake being sufficient to cause every duck to leave the lake at once. Many of the old birds, especially on Lake 16, still had their young with them, though well grown.

Wood Duck. *Aix sponsa* (Linn.)

None were seen, though the hunters of the region all reported them as not uncommon summer residents.

American Bittern. *Botaurus lentiginosus* (Montagu).

Very common in suitable swampy places. These birds were found about practically every body of water, irrespective of its size, provided only that there was open swamp for them to feed in. Not confined to the cat-tail marshes, which are few in this section of the county. The "pumping" of this species was often heard. Undoubtedly a breeding species.

Least Bittern. *Ixobrychus exilis* (Gmelin).

Whether these birds are really uncommon, or whether it is their seclusive habits that keep them from being seen, is hard to say. A single individual was observed at Lake 16, flying low over the sphagnum marsh.

Great Blue Heron. *Ardea herodias herodias* Linn.

Not common, yet quite a number were seen. Found mostly in small groups of two or three, and were very timid. They seem to shun the open marsh when the American Bittern is found, and to prefer locations where the tangled woods extend nearly

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to the water's edge. Here they wade stealthily knee-deep in the clear water, or stand motionless on some twisted half-sunk tree trunk, and feast on the minnows *(Notropis cornutus)* swarming around them.

Virginia Rail. *Rallus virginianus* Linn.

Common in the rushy places along the Kenton river, and in all the wet marshes about the lakes. More often heard than seen.

Sora. *Porzana carolina* (Linn.)

A single individual was seen early on the morning of August 15 crossing a point of land near camp on Lake 33. Probably more common than data indicate.

Coot. *Fulica americana* Gmelin.

Three were seen on Lake 16, and two spent the day of August 17 on Lake 33. At Lake 16, the remains of what undoubtedly was a coot nest of that season's make was found.

Woodcock. *Philohela minor* (Gmelin).

Rare. The writer was fortunate enough to flush a single individual from a rather dense thicket near Kenton. The hunters say they have not seen or heard of woodcock in the neighborhood for some years, though they formerly were more common.

Wilson Snipe. *Gallinago delicata* (Ord).

Two "Jack" snipe were located in a rather high marsh, entirely free from sphagnum, just east of Kenton.

Least Sandpiper. *Pisobia minutilla* (Vieillot).

A single individual of this species was found wading along the sandy shore of Lake 33, evidently feeding. The bird was very tame, allowing the observer to get within ten feet of it.

Spotted Sandpiper. *Actitis macularia* (Linnaeus).

The most common of the sandpipers, but found only along water-courses where timber and an excess of vegetation is lacking. Often seen along the Kenton river in Houghton county, and about Lakes 33 and 16, and streams tributary to them.

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Killdeer. *Oxyechus vociferus* (Linnaeus).

Common about Kenton in the open fields and pastures. These birds breed in this neighborhood, as young birds were often seen.

Ruffed Grouse. *Bonasa umbellus* (Linn.).

Abundant. These birds are found wherever there is a sufficiently dense growth of trees and underbrush. Found in the "cut-over" region, about Kenton, as well as in the second-growth area; abundant in the woods about Lakes 16 and 33, and apparently as plentiful in the pine as in the hard. Seldom found separately.

Mourning Dove. *Zenaidura macroura carolinensis* (Linn).

Several were seen in the vicinity of Kenton. They frequent the open areas rather than the dense woods, and may sometimes be found feeding upon the ground in perfectly open, brush-free clearings, though they are quite wary.

Marsh Hawk. *Circus hudsonius* (Linn).

Three individuals were seen during the week spent at Lake 33, all females, and all flying rather high for this species.

Sharp-shinned Hawk. *Accipiter velox* (Wilson).

Seen only in the vicinity of Kenton, where they were found commonly in the clearings and burned areas.

Cooper Hawk. *Accipiter cooperi* (Bonaparte).

A single bird of this species was seen perched on a fence post north of Kenton.

Red-tailed Hawk. *Buteo borealis borealis* (Gmelin).

Found quite commonly in the more open country about Kenton. Eleven individuals were identified, five of which were the finest speciments the writer has seen.

Broad-winged Hawk. *Buteo platypterus* (Vieillot).

Several hawks, presumably of this species, were seen near Kenton, though but a single bird was satisfactorily identified. They are very timid.

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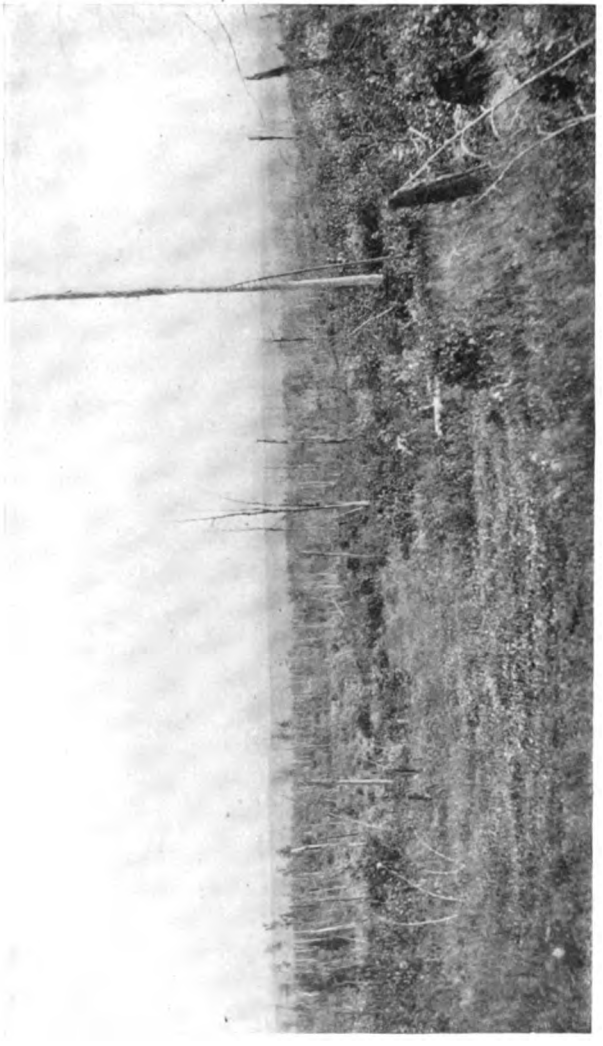

CUT OVER AREA NEAR KENTON · THE HOME OF FALCO SPARVERIOS

COCKAYNE BOSTON

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Sparrow Hawk. *Falco sparverius sparverius* Linn.

Abundant; the writer has never seen a species of hawk more plentiful, or more tame. The region about Kenton is simply alive with hawks, the majority being of this species. On one "cleared" field, on which, however, were a number of dead pine shafts, the writer counted no less than twenty-two birds of this species, the area being certainly not over an acre and a half in extent. Mice of various sorts *(Peromyscus* sp., *Microtus* sp.) as well as a number of large species of grasshoppers seem to be the chief food of the birds.

Bald Eagle. *Haliaetus leucocephalus leucocephalus* (Linn.).

Three birds, two with the white head and tail, were seen for several days about Lake 33. They were extremely wild and impossible of approach, and spent much of their time perched on the topmost branch of the highest dead tree on the landscape (which tree was, by the way, higher than any living tree in sight).

Osprey. *Pandion haliaetus carolinensis* (Gmelin).

Several Fish-hawks were seen at different times about Lake 33 and the smaller lakes beyond. They seemed to be traveling, and did not linger more than a few minutes about the lake. Only one bird was seen to feed, and this one caught but a single small fish, probably *Notropis cornutus.*

Barred Owl. *Strix varia* Barton.

Not a single bird of this species was seen, but hardly a night passed while at Lake 33 that the writer did not hear from two to six individuals hooting from the pines. Three large owl pellets were found, very likely from this species, which contained the remains of nineteen mouse skulls *(Peromyscus maniculatus gracilis),* and a great number of bones and masses of hair.

Screech Owl. *Otus asio asio* (Linn).

Heard twice while at Lake 33, and once while at Kenton. Apparently not very common.

Black-billed Cuckoo. *Coccyzus erythrophthalmus* (Wilson).

Two birds of this species were seen along an abandoned logging road near Kenton. The birds were shy, and kept well concealed in the underbrush.

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Kingfisher. *Ceryle alcyon* (Linn).

Found wherever there is a river or a lake. Several were seen daily flying up and down the Kenton river, and two nest-holes were found in a gravelly bank above the water. Quite common about Lake 33, where, toward evening they would hover for minutes at a time before plunging for a meal.

Hairy Woodpecker. *Dryobates villosus villosus* (Linn).

Four Hairy Woodpeckers were seen about the shores of Lake 33, and one on Duck Island, at one corner of the Lake. Not very common.

Downy Woodpecker. *Dryobates pubescens medianus* (Swainson).

Very common. Found both at Kenton and at Lake 33, but not in the deep evergreen woods. A young bird of this species, badly mutilated by either a hawk or owl was found at Lake 16.

Yellow-bellied Sapsucker. *Sphyrapicus varius varius* (Linn).

But two were seen, both of these in a boggy opening in the forest near Lake 33. However, the work of the birds on the tree trunks in certain areas would lead one to the belief that the birds are much more common than this data would imply.

Northern Pileated Woodpecker. *Phloeotomus pileatus abieticola* (Bangs).

One fleeting glimpse of this large woodpecker near Lake 33 was the best the writer could do, although the hammering of the species, unmistakable beyond a doubt, was heard on several occasions. Denizens of the deepest forest, their tatooing on a hollow tree-trunk can be heard at a very great distance, (the writer believes nearly two miles), and the birds are extremely shy and difficult of approach.

Red-headed Woodpecker. *Melanerpes erythrocephalus* (Linn).

Found quite commonly in the cleared or burned over region about Kenton, and not seen in the forests about the lakes. Five birds in immature plumage would indicate that the bird is a breeding species.

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Flicker. *Colaptes auratus luteus* Bangs.

Common about the clearings, though two were seen at the edge of the woods about Lake 16. Immature birds were seen frequently at Kenton, and the birds undoubtedly breed here.

Whip-poor-will. *Antrostomus vociferus vociferus* (Wilson).

Heard but once, at dusk on August 19, when its call, three times repeated, came from the far side of Lake 33. Is said to be not uncommon, though practically never seen.

Nighthawk. *Chordeiles verginianus virginianus* (Gmelin).

Several were seen constantly about the planing-mill at Kenton, and at Lake 33 a single individual performed one twilight over the middle of the lake. Blackwelder gives the bird as abundant, while the writer saw eight at most in the opposite corner of the same county.

Chimney Swift. *Chaetura pelagica* (Linn).

Seen quite commonly around the settled places, and occasionally in unsettled clearings, though none were seen in the uninhabited lake region.

Ruby-throated Hummingbird. *Archilochus colubris* (Linn).

But a single rub-throated was seen. The writer was watching a Bald Eagle circling over Lake 33, when a Ruby-throat lit on a dead twig almost in front of his face. The contrast in size of the two birds was in the nature of a decided shock. A humming bird never seemed so small or so out of place as did that particular bird out there in the heart of the woods, where there were practically no flowers of showy color or attractive size.

Kingbird. *Tyrannus tyrannus* (Linn).

Several were seen in the clearings along the Kenton river and about the town itself. They seem to spend most of their time chasing or annoying sparrow hawks and crows.

Phoebe. *Sayornis phoebe* (Latham).

Quite common about the houses and barns of Kenton, and along the river where the vegetation is not too dense. Two nests were found under a bridge across the Kenton river, one containing three broken eggs.

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Wood Pewee. *Myiochanes virens* Linn.

Quite common around the outskirts of Kenton and thro the forest regions. Rarely seen in the open, the pewee i heard singing to itself in the heart of the woods where i it is one of the characteristic birds. Remains of what the has no doubt was a Pewee's nest was found in a Norway near Lake 16.

Least Flycatcher. *Empidonax minimus* W. M. and Baird.

This species would have been overlooked had it not begu call its "chebeck" note just when it did as only one bird found and that in the deepest pine woods around Lake 33.

Prairie Horned Lark. *Otocoris alpestris praticola* Henshaw

None were seen, but Blatchley found it in the southe part of the county: "Evidently an immigrant from the nor A few were seen on the barren horned plains but favorable alities are still few, and must have been quite lacking a gener tion ago".

Blue Jay. *Cyanocitta cristata cristata* Linn.

A common bird in nearly every type of situation from th clearings to the dense woods of the lake region. There is a marked contrast in the voicelessness of birds in different local ities: those of the open clearings are noisy and always very much in evidence, those in the forests silent and almost retiring.

Canada Jay. *Perisoreus canadensis canadensis* Linn.

A single "Lumber Jack" was seen near Lake 33 on August 19. From records the bird is normally a winter resident, though a few individuals probably remain the year around.

Northern Raven. *Corvus corax principalis* Ridgway.

Three birds of this species were seen together in the deep woods near Lake 33. As the party approached they rose from the ground, where they were feeding on a dead Porcupine, and without a sound sailed off over the silence of the forest, a note-worthy contrast to the noisy crows which probably have made

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Wood Pewee. *Myiochanes virens* (Linn.).

Quite common around the outskirts of Kenton and throughout the forest regions. Rarely seen in the open, the pewee is often heard singing to itself in the heart of the woods where, in fact, it is one of the characteristic birds. Remains of what the writer has no doubt was a Pewee's nest was found in a Norway pine near Lake 16.

Least Flycatcher. *Empidonax minimus* (W. M. and S. F. Baird).

This species would have been overlooked had it not begun to call its "chebeck" note just when it did, as only one bird was found, and that in the deepest pine woods around Lake 33.

Prairie Horned Lark. *Otocoris alpestris praticola* Henshaw.

None were seen, but Blackwelder found it in the southeast part of the county: "Evidently an immigrant from the south. A few were seen on the barren burned plains, but favorable localities are still few, and must have been quite lacking a generation ago".

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Three birds of this species were seen together in the deep woods near Lake 33. As the writer approached they rose from the ground, where they were feeding on a dead Porcupine, and without a sound, slipped off into the silence of the forest, a noteworthy contrast to the racket three crows would probably have made.

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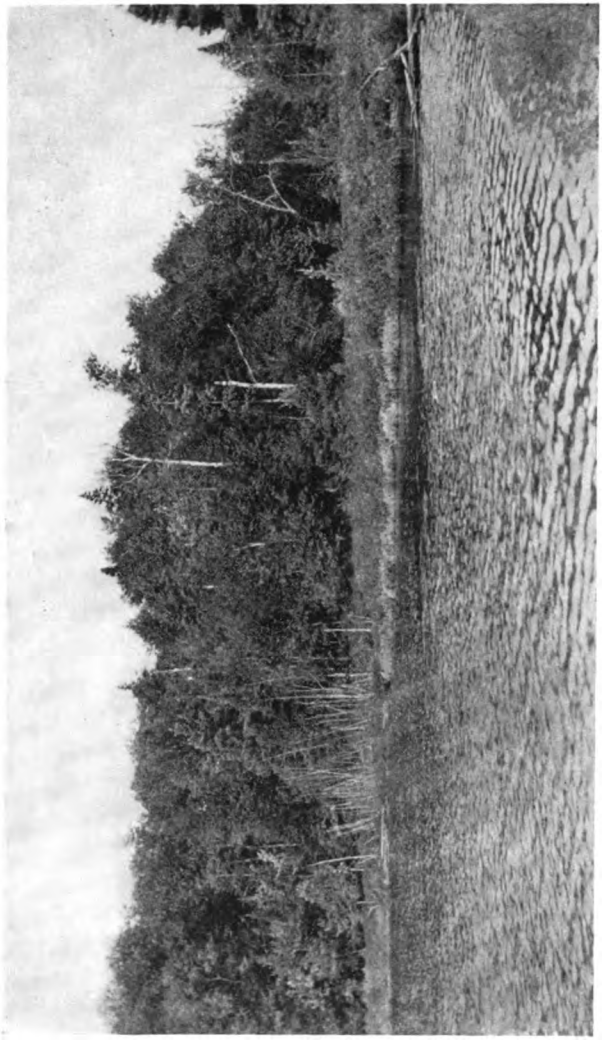

A TYPICAL LAKE SHORE: SMALL LAKE BEYOND LAKE 33

COCKAYNE BOSTON

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Crow. *Corvus brachyrhynchos brachyrhynchos* Brehm.

Quite common about the villages and clearings, especially around Kenton.

Cowbird. *Molothrus ater ater* (Boddaert).

Common about clearings and farm houses and in the village streets. A fully grown young of this species was seen in constant attendance upon a female white-throated sparrow.

Red-winged Blackbird. *Agelaius phoeniceus phoeniceus* (Linn).

Found quite commonly along the Kenton river, and about the smaller lakes in the Lake 33 region. Old nests were found in the cat-tail swamps.

Meadowlark. *Sturnella magna magna* (Linn).

Around Kenton this species was seen several times, and heard nearly every day. Though the meadowlark is not as abundant as in the southern peninsula, it is to be found in practically all of the clearings, and not in any other location, as would be expected.

Rusty Blackbird. *Euphagus carolinus* (Müller).

In the neighborhood of the towns this species is quite common, though they are seldom seen actually in the towns themselves.

Bronzed Grackle. *Quiscalus quiscula aeneus* Ridgway.

A number of bronzed grackles were seen, both in the vicinity of Kenton, and in the swamp bordering Lake 16. Can hardly be considered common.

Purple Finch. *Carpodacus purpureus purpureus* (Gmelin).

A flock of fourteen individuals was seen near Lake 16, and in the second-growth pines about Kenton several smaller flocks were found.

Goldfinch. *Astragalinus tristis tristis* (Linn).

Common throughout the country visited, but confined more especially to the more open country. A deserted nest with five eggs was found near Kenton.

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Pine Siskin. *Spinus pinus* (Wilson).

None were found, but the species is listed by Blackwelder: "The Siskins may be seen in small bands in the latter part of the summer, and are especially characteristic of cedar swamps".

English Sparrow. *Passer domesticus* (Linn).

Common, but confined very closely to the towns. Their chief pastime in this region seemed to be breeding, due perhaps to the late spring and the early fall.

Vesper Sparrow. *Pooecetes gramineus gramineus* (Gmelin).

Found commonly along the paths and road-sides, and along the edges of the cultivated fields, but only in the vicinity of the towns. In full song all during August.

White-crowned Sparrow. *Zonotrichia leucophrys leucophrys* (J. R. Forster).

Two individuals of this species were seen about Lake 16. They were feeding on the ground, in company with several white-throats.

White-throated Sparrow. *Zonotrichia albicollis* (Gmelin).

Common, and, as pointed out by Blackwelder, the characteristic summer bird of the region. Found less commonly about the towns, it is much in evidence in the deep woods about the lakes in Iron county, where its song was heard many times a day. Found often about the Sphagnum bogs and in the blueberry marshes. Seldom seen except in flocks.

Chipping Sparrow. *Spizella passerina passerina* (Bechstein).

Seen and heard daily in the vicinity of Kenton, and for about a mile up the Kenton river, above the town. Apparently confined rather closely to the towns.

Field Sparrow. *Spizella pusilla pusilla* (Wilson).

Only three birds of this species were seen, and one heard, all about Kenton, in the open, cultivated fields.

Slate-colored Junco. *Junco hyemalis hyemalis* (Linn).

Seen frequently along the abandoned logging roads, and about the outskirts of the town. They were perfectly silent.

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Song Sparrow. *Melospiza melodia melodia* (Wilson).

Abundant throughout the Kenton district. Found in full song throughout the town itself, and in nearly every open field. A nest with three young song-sparrows and an enormous young cowbird was found in a raspberry bush near Kenton.

Towhee. *Pipilo erythrophthalmus erythrophthalmus* (Linn).

Probably more common than present data would indicate, as only one bird, a male, was seen. This was in the back yard of a house in Kenton.

Rose-breasted Grosbeak. *Zamelodia ludociana* (Linn).

A male of this species was heard—and found—in a small clearing near Lake 16.

Indigo Bunting. *Passerina cyanea* (Linn.).

Like the junco, the indigo bunting is confined to the outskirts of the towns. Probably breeds in the neighborhood as two young birds not long from the nest, and presumably of this species (unfortunately the writer was unable to obtain one) were seen just outside of Kenton.

Scarlet Tanager. *Piranga erythromelas* Vieillot.

A single female was seen near the summit of an old slashing.

Purple Martin. *Pronge subis subis* (Linn.).

A breeding species in small numbers in many of the towns. Late in the afternoon of August 19 a single bird of this species was seen flying about over Lake 33, but this must be regarded as an exceptional case.

Barn Swallow. *Hirundo erythrogaster* Boddaert.

Breeds quite abundantly in the barns and deserted buildings of the towns.

Tree Swallow. *Iridoprocne bicolor* (Vieillot).

Found commonly in the open swamps, where they breed in any suitable dead tree.

Bank Swallow. *Riparia riparia* (Linn.).

Found only along the Kenton river, where there are occasional breeding sites well riddled with nest holes. Very local in distribution.

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Cedar Waxwing. *Bombycilla cedrorum* Vieillot.

Although seen but once near Kenton, the cedar bird was heard on several occasions both near Lake 16 and Lake 33. There was no evidence of breeding, though it must have been the proper time.

Red-eyed Vireo. *Vireosylva olivacea* (Linn.)

The monotonous song of this vireo was heard continually through the days at Kenton. On two occasions it was heard singing near Lake 33, but far from the swampy border, and in a typical hardwood formation.

Black and White Warbler. *Mniotilta varia* (Linn.).

Not very common, though about a dozen individuals were seen. Frequent nearly any species of tree found in the dryer portions of the forests, and apparently seldom approach the lakes.

Yellow Warbler. *Dendroica aestiva aestiva* (Gmelin).

Abundant throughout the more open and settled country, and none were seen in the Lake 33 region. Many deserted nests were found around Kenton.

Myrtle Warbler. *Dendroica coronata* (Linn.).

Several individuals of this species were seen near Kenton, feeding among the blueberry bushes about the more open fields.

Chestnut-sided Warbler. *Dendroica pensylvanica* (Linn.).

Two males visited camp near Lake 33 early one morning, and remained in the vicinity for two days. A lone female was seen at the shore of Lake 16.

Black-poll Warbler. *Dendroica striata* (J. R. Forster).

Several birds were found near Kenton, diligently investigating the bark of the second growth pines. Apparently a summer resident, but there are no breeding data.

Black-throated Green Warbler. *Dendroica virens* (Gmelin).

A single male of this species was seen in a back yard in Kenton the day of the writer's arrival, and no more evidence as to its occurrence was found.

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Oven-bird. *Seiurus aurocapillus* (Linn.).

Heard far more often than seen in the swampy areas about the lakes in Iron county. Several were seen sneaking along in the bushes at the shore of the Kenton river.

Water-thrush. *Seiurus noveboracensis noveboracensis* (Gmelin).

Found quite commonly along the Kenton river, especially where vegetation overhangs the water, and once on the shore of Lake 33.

Maryland Yellow-throat. *Geothlypis trichas trichas* (Linn.).

Several were both seen and heard along the Kenton river, and hardly a day passed but one or more was heard near Lake 33. Several were heard also along the shore of Lake 16.

Canadian Warbler. *Wilsonia canadensis* (Linn.).

None were seen, but Blackwelder reports the species for "late in August, and therefore perhaps not a summer resident."

American Redstart. *Setophaga ruticilla* (Linn.).

Several were seen in the hardwoods near Kenton, but the species is to be considered as rather uncommon, though possibly a breeding species, as several immature birds were seen, and one taken.

Catbird. *Dumetella carolinensis* (Linn.).

Several individuals were seen about Kenton, and an old nest, undoubtedly of this species and from the preceding season was found in a thicket near the Kenton river.

Brown Thrasher. *Toxostoma rufum* (Linn.).

Seen on several occasions about Kenton, where it keeps to the thickets, especially along the river. Heard in full song but once, though often fragments of its song were heard.

House Wren. *Troglodytes aëdon aëdon* (Vieillot.)

Several were seen near Kenton and the nest of one pair was found in the corner of the abandoned planing-mill.

Winter Wren. *Nannus hiemalis hiemalis* (Vieillot).

Somewhat more common perhaps than the preceding species, but not very common at that. They frequent the thickets and

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brush-piles and are very secretive, which may well account for the few seen.

White-breasted Nuthatch. *Sitta carolinensis carolinensis* Latham.

Only two individuals were seen, both near Kenton.

Red-breasted Nuthatch. *Sitta canadensis* Linn.

Somewhat more common than the preceding species, yet probably not over twelve or fifteen individuals were seen all told. Several were seen about the clearings of Kenton, and several more about Lakes 16 and 33.

Chickadee. *Penthestes atricapillus atricapillus* (Linn.).

Seen and heard practically every day while in the woods. About Lake 33 the species was common, and remarkably tame, and there were usually two or more "hanging" about camp. Undoubtedly a breeding species, yet no evidence is at hand.

Golden-crowned Kinglet. *Regulus satrapa satrapa* Licht.

None of this species was seen, but it is listed by Blackwelder.

Ruby-crowned Kinglet. *Regulus calendula calendula* (Linn.).

Seen twice, both times about camp on Lake 33. They were silent, and did not remain long in the vicinity.

Blue-gray Gnatcatcher. *Polioptila caerulea caerulea* (Linn.).

Three birds of this species were seen on separate occasions,—once in Kenton, and twice about the small lakes of Iron county.

Wood Thrush. *Hylocichla mustelina* (Gmelin).

Not common, but found—and ocassionally heard—in the thickets about the towns.

Wilson's Thrush. *Hylocichla fuscescens* (Stephens).

Not common; found often in close proximity to the towns. Heard in song but once.

Olive-backed Thrush. *Hylocichla ustulata swainsoni* (Tschudi).

None seen, but listed by Blackwelder.

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Hermit Thrush. *Hylocichla guttata pallasi* (Cabanis).

Several hermit thrushes were seen in the vicinity of Kenton. This species is more common than any of the preceding three. It was not heard in song.

Robin. *Planesticus migratorious migratorious* (Linn.).

Quite common about the towns, and seldom seen at any considerable distance from them. Several nests, evidently of that same season, were found in the corners of buildings—especially of deserted barns and houses.

Bluebird. *Sialia sialis sialis* (Linn.).

Very few bluebirds were seen, and these were always in close proximity to "civilization". A young bluebird, fully grown, but with the characteristic immature plumage, was found, indicating breeding in the neighborhood.

SUMMARY OF AVES.

The following are the new records of birds seen in either or both counties, based on Blackwelder's: "Summer Birds of Iron County."

Larus argentatus
Mergus serrator
Anas platyrhynchos
Anas rubripes
Aix sponsa
Ixobrychus exilis
Rallus virginianus
Prozana carolina
Fulica americana
Philohela minor
Gallinago delicata
Pisobia minutilla
Zenaidura macroura carolinensis
Circus hudsonius.
Accipiter cooperi
Haliaetus leucocephalus leucocephalus
Otus asio asio
Coccyzus erythrophthalmus
Zonotrichia leucophrys leucophrys
Iridoprocne bicolor
Dencroica coronata
Dendroica pensylvanica
Sitta carolinensis

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MAMMALIA

Northern Virginia Deer. *Edocoileus americanus borealis* (Miller).

Still abundant in both counties, though signs of their presence are more common than a sight of the animals themselves. Fresh footprints were found in the soft sand along the shore of the Kenton river within a little over a stone's throw of the town. At Lake 33 several were seen every day as they came to the water at different points. However, many more were seen and heard at night when they were "spotted" for photographic purposes.

Red Squirrel. *Sciurus hudsonicus loquax* (Bangs.)

This is the only species of squirrel seen; though it occurs in both counties, it is certainly not abundant. Several were heard at different times in the woods about Kenton, and one was taken for identification. About Lake 33 but two were seen, and here again a specimen was procured.

Lake Superior Chipmunk. *Eutamias quadrivittatus neglectus* (Allen).

This little chipmunk is the commoner of the two species found, being relatively abundant in both counties. It may be distinguished from the next species in a moment by its small size, if not by the difference in the coloration and markings. It was found all through the woods wherever there were fallen logs or stumps, and was very shy and wary.

Northeastern Chipmunk. *Tamias striatus lysteri* (Richardson).

Seen only in Houghton county, where one specimen was collected to prove the co-existence of the two species in the same formation. This species is not as abundant as the preceding, though found in practically the same places.

Canadian Woodchuck. *Marmota monax canadensis* (Erxleben).

Woodchucks are common in both counties, though the type of country visited in Houghton county was more suited to their life, and consequently more evidences of their activity were

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found there. As nearly as the writer can make out at present, there is but the one subspecies of woodchuck found in this section of the north peninsula and it is probable that the subspecies *rufescens* does not occur as far north as this.

Northern Flying Squirrel. *Sciuropterus sabrinus* (Shaw).

The flying squirrel occurs in both counties, though it is but occasionally met with. The body of one that accidentally got into a steel trap was the only flesh specimen seen; this in Houghton county.

Woods Beaver. *Castor canadensis michiganensis* (Bailey).

Still to be found in each of the counties, though from the signs of former activity the animals are not nearly as numerous as in past years. A lodge in fairly good repair was found in one of the small lakes beyond Lake 33, and some fairly fresh cuttings were noted in this same general region. There are still several small colonies within about four miles of Kenton.

Norway Rat. *Epimys norvegicus* (Erxleben).

According to all reports, this is a comparatively recent addition to the mammalian fauna of Houghton county, and at present the writer can offer no data as to its occurrence in Iron. Although not common in Houghton county, it occurs about Kenton not infrequently, and two were seen about the deserted buildings of the old planing-mill. Tracks of the species were also found in the mud at the edge of the Kenton river, as was a badly mutilated dead specimen.

House Mouse. *Mus musculus* (Linn).

Rather common about some of the wooden dwellings of Kenton, and no signs of its occurrence in Iron county, though its presence there was not to be expected owing to the type of country visited.

Michigan Mouse. *Peromyscus maniculatus gracilis* (Le Conte).

This large deer mouse occurs in Houghton county rather plentifully, but in no such abundance as it was found in Iron county about Lake 33. In this region it is the most common small mammal, and though strictly nocturnal in habits, it succeeds in mak-

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ing its presence known through many long successful raids on the food box. A "catch-'em-alive" mouse trap was placed in front of a small hole under a decayed log near camp, and three were caught in less than ten minutes. Their holes were to be found under nearly every stump or fallen log, and at night they could be heard scampering about among the leaves.

Meadow Mole. *Microtus pennsylvanicus* (Ord).

Probably more abundant in both counties than present data would indicate. In the fields about Kenton several were seen, while but a single individual was found in the Lake 33 region. This one was accidentally stepped on one evening while going through a rather open area to the spring. About Kenton they live in thick tangles of brush or under upright remains of cut pines, not having been found under fallen or decayed wood.

Northern Muskrat. *Ondatra zibethica zibethica* (Linn.).

Common in both Houghton and Iron Counties, but more abundant in Iron, due no doubt to the fact that they are less trapped and annoyed there. Two specimens were caught near camp at Lake 33, one a kit and one an adult female, both having as pretty fur as the writer has seen on muskrats. In this region the rats are more active during the day than is customary for the species elsewhere.

Canada Porcupine. *Erethizon dorsatum* (Linn.).

Abundant in both counties, though more so in Iron than in Houghton. While not seen often in the immediate vicinity of Kenton (and there is good reason why they should not be), their teeth-marks on old buildings bear ample witness to their presence. About Lake 33 the animals were abundant, and were often a nuisance when we were out photographing deer by night.

Minnesota Varying Hare. *Lepus americanus phaeonotus* (Allen).

Found rather commonly in both counties, and is the only form of rabbit found, so far as the writer can ascertain. Not often seen during the summer, but tracks and faeces are often found either in the deep woods or near the edge, and but seldom in the open fields.

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Canada Lynx. *Lynx canadensis* (Kerr).

Said by hunters to occur infrequently, though nothing was seen of the species by the writer. Listed by Wood from Iron county.

Bay Lynx. *Lynx ruffus* (Gueldenstaedt).

A single specimen, caught by a trapper in Houghton county during the writer's stay in Iron, was the only fresh specimen seen. Found, however, according to reliable reports, in both counties, though not very commonly.

Timber Wolf. *Canis Occidentalis* (Richardson).

Still fairly common in both counties, though the animal itself is not often seen unless in a trap. Tracks, however, are found quite often, both near Kenton and in the Lake 33 region. In the latter place they were to be heard practically every evening calling in the distance. Though they are still hunted seriously, it is doubtful whether in their present depleted numbers they do much damage.

Brush Wolf. *Canis latrans* (Say).

Although none of this species was seen, the descriptions of reliable hunters makes it certain that the "brush wolf" is this species. Occurs in both counties, though not commonly.

Red Fox. *Vulpes fulva* (Desmarest).

Still found occasionally in both counties, though not commonly in either.

Gray Fox. *Urocyon cinereoargenteus* (Schreber).

Found in both counties, though not commonly. Tracks of what could hardly have been anything else were found in the sand road in the slate quarry en route to the Lake 33 region.

Northern Black Bear. *Ursus americanus* (Pallas).

Not uncommon in both counties, and though none were seen by the writer personally, a member of the party saw one near the slate quarry above mentioned, and en route to Lake 33 foot-prints were seen in several places and excrement found. There are undoubtedly quite a few left, though of course they are rarely seen.

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American Badger. *Taxidea taxus* (Schreber).

None was seen by the writer, but there is a colony of some size not far from Kenton in Houghton county.

Northern Skunk. *Mephitis hudsonica* (Richardson).

Quite common in both counties, though the only one taken—or for that matter seen—was at camp by Lake 33. This little fellow made himself too free about camp, and after he had taken his own photograph several times, he was trapped in his hole not far off. A number of holes were found in this general neighborhood which showed good signs of being inhabited by this species, and there are undoubtedly a good many around.

Fisher. *Martes pennanti* (Erxleben).

It is quite certain that none have been taken within recent years so far as the region about Kenton and Lake 33 are concerned, though report and rumor have it that they have been taken in Houghton county not so very long ago. Wood (4) reports the species from both counties, so it is not unlikely that they may even yet occur.

Northeastern Mink. *Mustela vison* (Schreber).

Not uncommon in the region about Kenton, where, in season, they are trapped quite extensively, but none were seen. About Lake 33, however, they certainly were as abundant as one could ask for, and were seen often by day as well as by night when out photographing deer.

New York Weasel. *Mustela noveboracensis* (Emmons).

Common in both counties, though but one individual was seen in each. One was seen early one morning along the bank of the Kenton river; the other in the middle of the day between Lake 33 and one of the smaller lakes beyond.

Canada Otter. *Lutra canadensis* (Schreber).

Like the fisher, the otter is reported, though it certainly is now about gone from both counties, if not entirely so. Wood (4) reports it from Iron county, and it undoubtedly has occurred in both rather recently.

Short-tailed Shrew. *Blarina brevicauda* (Say).

It is hard to say just what the status of this seclusive little fellow it. A single dead specimen was found at Kenton, otherwise the writer would have no data whatsoever on the species.

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Star-nosed Mole. *Condylura cristata* (Linn.).

Although none was seen in either county, unmistakable evidence in the form of tunnels which could only have been made by this animal were found in wet places both in Iron and in Houghton counties. The woodsmen also tell of the "funny mouse with the thing on its nose" which undoubtedly refers to this species.

Say's Bat. *Myotis subulatus* (Say).

Occurs commonly in both counties, though a specimen was secured only at Lake 33. About Kenton the species is found on the wing only well along toward dusk, unless disturbed, while out in the woods it becomes active early in the afternoon, and begins to fly around long before dusk. One little fellow in particular that stayed about camp—known because of a rent in the wing—started out on his travels about four-thirty every afternoon, and was busy catching insects over the lake certainly until dark.

SYNOPSIS OF MAMMALS.

Species.	Iron.	Houghton.
Odocoileus americanus borealis	a	*a
Sciurus hudsonicus loquax	*f	f
Eutamias quadrivittatus neglectus	c	c
Tamias striatus lysteri	—	*f
Marmota monax canadensis	*c	*c
Sciuropterus sabrinus	*f	*f
Castor canadensis michiganensis	f	*f
Epimys norvegicus	—	*f
Mus musculus	—	*f
Peromuscus maniculatus gracilis	a	*c
Microtus pennsylvanicus	*c	*c
Ondatra zibethica zibethica	a	*c
Erethizon dorsatum	a	*c
Lepus americanus phaeonotus	*c	c
Lynx canadensis	x	—
Lynx ruffus	f	*f
Canis occidentalis	c	*f
Canis latrans	*f	*f
Vulpes fulva	f	*f
Urocyon cinereoargenteus	*f	*f
Procyon lotor	x	—
Ursus americanus	f	f
Taxidea taxus	—	f
Mephitis hudsonica	c	*c
Martes pennanti	x	x
Mustela vison	a	c
Mustela noveboracensis	c	*c
Lutra canadensis	x	—
Blarina brevicauda	—	1
Condylura cristata	*f	c
Myotis sublatus	*c	*c
Eptesticus fuscus	—	x

(In the above table: * = new record for county; c = common; f = few; x = reported previously, but not found by the writer.)

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October 26, 1915.

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A REVIEW OF THE PLOVER GENUS OCHTHODROMUS REICHENBACH AND ITS NEAREST ALLIES

By Harry C. Oberholser.

The present study originated in the desire to determine the proper generic name for the plover commonly known as *Ochthodromus wilsonius* (Ord). This proved to be much more of a task than it at first appeared; and it finally involved not only all the species currently referred to the genus *Ochthodromus*, but some of other genera as well. The interesting, and in one or two cases rather surprising, results seem to be worth publication.

The innocent cause of all this trouble was originally introduced to science by Ord under the name *Charadrius wilsonia*;[1] and for some 65 years has been known to authors as *Ochthodromus wilsonius* (Ord), having been made by Reichenbach the monotypic type of his genus *Ochthodromus*.[2] In the same generic group Dr. R. B. Sharpe has placed the following species:[3]

1. *Ochthodromus obscurus* (Gmelin).
2. *Ochthodromus bicinctus* (Jardine and Selby).
3. *Ochthodromus wilsoni* (Ord).
4. *Ochthodromus geoffroyi* (Wagler).
5. *Ochthodromus mongolus* (Pallas).
6. *Ochthodromus pyrrhothorax* (Gould).
7. *Ochthodromus asiaticus* (Pallas).
8. *Ochthodromus veredus* (Gould).

Recently Mr. G. M. Mathews has shown[1] that the name *Ochthodromus* is preoccupied by *Ochthedromus* LeConte, as well as antedated by *Eupoda* Brandt,[2] and he proposed to use the latter

[1] In Wilson's Amer. Ornith., IX, 1814, p. 77, pl. 73, fig. 5 (Cape Island, now Cape May, New Jersey).
[2] Natürl. Syst. Vögel, 1852 (1853) p. XVIII.
[3] Cat. Birds Brit. Mus., XXIV, 1896, pp. 209–234.
[1] Novit. Zool., XVIII, No. 1, June 17, 1911, p. 5.
[2] In Tchihatcheff's Voy. Sci. Altai Oriental, 1845, p. 444.

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name for the group. Still later[3] Mr. Mathews returned to the subject and divided the genus *Ochthodromus* of Sharpe and of authors into five genera, by which arrangement the several species bore the following names, the numbers here prefixed corresponding to those of the species in Sharpe's genus *Ochthodromus*:

1. *Pluviorhynchus obscurus.*
4. *Ochthodromus (or Pagolla) wilsonius.*
3. *Ochthodromus (or Pagolla) wilsonius.*
5. *Cirrepidesmus mongolus.*
2. *Cirrepidesmus bicinctus.*
6. *Cirrepidesmus atrifrons (= pyrrhothorax* Wagler).
7. *Eupoda (or Eupodella) asiatica.*
8. *Eupoda (or Eupodella) verda.*

In the generic designations of two other species—*Podasocys montanus* (Townsend) and *Charadrius hiaticula* Linnaeus—which Mr. Mathews considered in the same connection, he made no alteration. His generic treatment of these birds was somewhat brief, but indicated plainly the need for recognizing a number of generic groups in place of the single one currently in use. A more detailed comparison of the various species involved, based on proportions obtained by actual measurements, which the present writer has made, shows that several changes from Mr. Mathews' arrangement seem necessary, the nature of which will be evident from the discussion in the ensuing pages. In addition to the species of *Ochthodromus*, the genus *Charadrius* Linnaeus (type, *Charadrius hiaticula)* is added for comparison.

The 8 species of plovers comprising Sharpe's genus *Ochthodromus* exhibit remarkable structural variations, and it is surprising that they have so long remained in a single genus. To ignore these differences as generic distinctions would be manifestly to obscure the relationships of the species; but as no two forms are exactly alike in these respects, it becomes a matter of determining the constancy and relative importance of these differences as generic characters. The structural differential characters of value among these plovers consist almost wholly in

[3] Birds Australia, III, pt. 1, April 2, 1913, pp. 81–84.

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the proportions of bill, feet, wing, and other parts. The shape of the tail does not seem to be a good character, since it is variable and not well correlated with other differences. The regularity of the tarsal reticulation, made use of in one or two instances by Mr. Mathews, does not seem to be either definite or constant enough for a generic character. Neither is mere size alone a satisfactory generic distinction. Nor does the present writer regard color pattern as a better, or even so fundamental a generic basis as structural differences. Furthermore, it does not seem to me at all advisable to separate generically species which differ *only* in color or color pattern. Mr. Pycraft's excellent remarks on this subject[1] should be read by everyone interested.

The measurements of which use is made in proportional comparisons in this paper have been taken as follows:

Length of wing.—The distance from the bend of the wing to the tip of the longest primary, taken with dividers without straightening the quills.

Length of tail.—The distance from the coccygeal insertion of the middle feathers to the tip of the longest rectrix.

Length of head.—The distance from the point where the feathers of the forehead end on the culmen to the hindmost point of the skull, taken in a straight line with dividers.

Exposed culmen (length of bill).—The chord of the culmen, taken from its tip to the point where the feathers of the forehead impinge on its base.

Height of bill at base.—The distance in a straight line from the base of the exposed culmen to the nearest point on the ramus of the mandible.

Width of bill at loral feathering.—Measured with dividers at the point on the side of the bill where the loral feathering ends.

Length of dertrum.—Measured in a straight line from the posterior end of the dertrum to its tip.

Length of tarsus.—A straight line from the center of the heel joint on the posterior side to the middle of the joint between the metatarsus and the middle toe on the anterior side.

Middle toe without claw.—Measured along the upper side from the middle of the joint between the metatarsus and the middle toe to the base of the uncovered portion of the claw.

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[1] Bull. Brit. Ornith. Club, XXXV, February 27, 1915, pp. 70–74; 85.

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Middle toe with claw.—Measured with dividers along the upper side from the middle of the joint between the metatarsus and the middle toe in a straight line to the tip of the claw.

Length of bare portion of tibia.—Measured from the middle of the heel joint to the *insertion* of the lowest feathers on the tibia.

The specimens on which this investigation has been based are contained in the United States National Museum, and for their use the writer is indebted to the authorities of the museum. To Mr. Robert Ridgway he is further under obligation for many helpful suggestions.

Key to Genera Allied to Eupoda Brandt.

a^1. Tarsus longer, about 2½ times the length of the middle toe without claw..... *Eupoda* (p.—).

a^2. Tarsus shorter, not over 2 times the length of the middle toe without claw.

b^1. Bill shorter, about ½ the length of head; tail 4½ times the length of exposed culmen ..... *Charadrius* (p.—).

b^2. Bill longer, more than ½ the length of head; bill 3½ times the length of exposed culmen, or less.

c^1. Wing 5½ to 6 times the length of exposed culmen; tail about 2½ times the length of exposed culmen.

d^1. Wing 4½ times the length of tarsus; tarsus 1¼ times the length of exposed culculmen ..... *Pluviorhynchus* (p.—).

d^2. Wing less than 4½ times the length of tarsus; tarsus more than 1¼ times the length of exposed culmen.

e^1. Bill longer and narrower—4/5 of the length of the head, and longer than the middle toe with claw; tarsus 2 times the length of middle toe without claw ..... *Pagoa* (p.—).

e^2. Bill shorter and wider—7/10 of the length of head, and shorter than middle toe with claw; tarsus much less than 2 times the length of middle toe without claw.. *Pagolla* (p.—).

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c^2. Wing 7 to 8½ times the length of exposed culmen; tail 3 to 3½ times the length of exposed culmen.

d^1. Bill narrower, the exposed culmen not iess than 3½ times the breadth of bill at loral feathering; wing not more than 7½ times the length of exposed culmen; dertrum less than ½ the length of exposed culmen..... *Pernettyva* (p.—).

b^2. Bill wider, the exposed culmen less than than 3½ times the breadth of bill at loral feathering; wing not more than 7½ times the length of exposed culmen; dertrum not less than ½ the length of exposed culmen.....*Cirrepidesmus* p.—).

Eupoda Brandt.

Eupoda Brandt, in Tchihatcheff's Voy. Sci Altai Oriental, 1845, p. 444 (type, by monotypy, *Charadrius caspius* Pallas [= *Charadrius asiaticus* Pallas]).[1]

Podasocys Coues, Proc. Acad. Nat. Sci Phila., XVIII 1866, p. 96 (type, by original designation and monotypy, *Charadrius montanus* Townsend.)

Eupodella Mathews, Birds Australia, III, pt. 1, April 2, 1913, p. 83, figs. 2 and 3 (type, by original designation, *Charadrius veredus* Gould) (proposed as an alternative name in case *Eupoda* be rejected by reason of the prior *Eupodes* Koch[2]).

Description.—Wing 2 1/3—2½ times the length of tail, 6½—7¼ times the length of exposed culmen, and 3 1/3—3¾ times the length of the tarsus; tail rounded, slightly double emarginate, or rounded with the two central rectrices projecting beyond the rest; its length 2½—3 times the length of exposed culmen, and 1 1/3—1 2/3 times the length of the tarsus; bill long and slender with its tip little if any expanded vertically, the angle of the gonys little emphasized, sometimes absent altogether, and the gonys little if any ascending; exposed culmen about 2/3 of the length of the head, 3¾—4½

[1] *Cf.* Mathews, Novit. Zool., XVIII, No. 1, June 17, 1911, p. 5.
[2] Postea, page ——

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times the height of bill at base, and 4—4¾ times the width of bill at loral feathering; dertrum slightly more than 2/5 of exposed culmen; tarsus 1¾—2 times the length of exposed culmen, and 2 1/3—2¾ times the length of middle toe without claw; bare portion of tibia 1 1/10—1 4/10 times the length of the middle toe without claw.

Type.—Charadrius asiaticus Pallas.

Remarks.—From *Eupoda asiatica,* the type of this genus, *Eupoda vereda* differs in having the tarsus somewhat longer, the bare portion of the tibia more extensive, the two central rectrices projecting decidedly beyond the rest, and in possessing several other minor structural differences; but these do not seem to justify its generic separation. Mr. Mathews has called attention to the differences which separate *Podasocys montanus* (Townsend) from *Eupoda vereda,*[1] which are virtually the same as those above mentioned as distinguishing *Eupoda vereda* from *Eupoda asiatica;* in other words, *Eupoda asiatica* is structurally almost identical with *Podasocys montanus,* differing only in very minor details, and as a matter of fact is not generically separable. The difference in tarsal reticulation mentioned by Mathews[2] proves on examination of a series of *Podasocys montanus* to be of no value at all, since both the irregular and the perfectly regular arrangements of the scales on the front of the tarsus occur among the individuals of this species. This bird must, therefore, in any case be called *Eupoda montana,* even if *Eupoda vereda* should be separated generically from *Eupoda asiatica.* As a natural consequence the generic name *Podasocys* Coues becomes a synonym of *Eupoda* Brandt.

Mr. Mathews seems to consider[1] that *Eupoda* Brandt is preoccupied by *Eupodes* Koch[2] for a crustacean and by *Eupodes* Jardine and Selby[3] for a weaver bird, but by both the International Code of Nomenclature and the American Ornithologists' Union Code these two names are not identical; and we, therefore, retain *Eupoda* Brandt for the present group of birds. Mr. Mathews further proposed the generic name *Eupodella*[4]

[1] Birds Australia, III, pt. 1, April 2, 1913, p. 84.
[2] Birds Australia, III, pt. 1, April 2, 1913, p. 84.
[1] Birds Australia, III, pt. 1, April 2, 1913, p. 83.
[2] Deutschl. Crust. I, 1835, Tab. 8.
[3] Illust. Ornith., new series, 1836, pl. 10.
[4] Birds Australia, III, pt. 1, April 2, 1913, p. 83, figs. 2 and 3.

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as an alternative name for *Eupoda* Brandt in case the latter proved to be preoccupied by *Eupodes;* but, since *Eupoda* is, as already shown, a perfectly tenable term, *Eupodella* becomes of course a synonym.

The species referable to this genus are, therefore, as follows:

Eupoda vereda (Gould).

Eupoda asiatica (Pallas).

Eupoda montana (Townsend).

Pernettyva Mathews.

Pernettyva Mathews, Birds Australia, III, pt. 2, May 2, 1913, p. 114 (type by original designation and monotypy, *Charadrius falklandicus* Latham).

Diagnosis.—Similar to *Eupoda,* but wing 4—4 1/3 times the length of tarsus; tail 1¾—2 times the length of tarsus; exposed culmen barely more than ½ the length of the head; tarsus only 1½—1 4/5 times the length of middle toe without claw; and the bare portion of tibia only 3/5—4/5 of the length of middle toe without claw.

Description.—Wing 2—2¼ times the length of the tail, 7—7½ times the length of the exposed culmen, and 4—4 1/3 times the length of the tarsus; tail rounded, or rounded with the two middle rectrices projecting beyond the rest, its length 3—3½ times the length of exposed culmen, and 1¾—2 times the length of the tarsus; bill slender and rather long, the terminal portion but little expanded vertically, the gonys moderately or but slightly angled and not strongly ascending; exposed culmen but slightly more than half the length of the head, about 3½ times the height of bill at base, and from 3½—4 times its breadth at the loral feathering; dertrum more than 2/5 but less than half the length of the exposed culmen; tarsus about 1¾ times the length of the exposed culmen, and from 1½—1 4/5 times the length of the middle toe without claw; bare portion of tibia 3/5—4/5 o fthe length of middle toe without claw.

Type.—Charadrius falklandicus Latham.

Remarks.—Mr. Mathews proposed the name *Pernettyva* as a subgeneric designation for *Charadrius falklandicus* Latham under the generic group *Leucopolius* of Bonaparte[1]; and at the same time he placed the species *Charadrius bicinctus* Jardine

[1] Birds Australia, III, pt. 2, May 2, 1913, p. 114.

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and Selby in the genus *Cirrepidesmus* Bonaparte, along with *Cirrepidesmus mongolus* and *Cirrepidesmus atrifrons* (= *pyrrhothorax*), but solely because of its similar color pattern. A careful comparison, however, of *Charadrius falklandicus* Latham and *Charadrius bicinctus* Jardine and Selby shows that the two belong undoubtedly in the same genus, since they differ only very slightly in relative length of exposed culmen, dertrum, middle toe without claw, and bare portion of the tibia, and in a few other unimportant particulars, including the shape of the tail. The generic name *Pernettyva* is therefore available for the group, the two species of which will stand as follows:

Pernettyva bicincta (Jardine and Selby).

Pernettyva falklandica (Latham).

Pluviorhynchus Bonaparte.

Pluviorhynchus Bonaparte, Comptes Rendus Acad. Sci., XLIII, No. 8, August 26–31, 1856, p. 417 (type, by subsequent designation [Sharpe, Cat. Birds Brit. Mus., XXIV, 1896, p. 209], *Charadrius obscurus* Gmelin).

Hyetoceryx Heine, Nomenclator Mus. Hein. Ornith., 1890, p. 336 (nom. nov. pro *Pluviorhynchus* Bonaparte, vox hybrida!).

Diagnosis.—Similar to *Pernettyva*, but wing 2½ times the length of the tail, 5½ times the length of the exposed culmen, and 4½ times the length of the tarsus; tail 2 1/3 times the length of the exposed culmen; bill stouter, the tip much more expanded vertically, the gonys sharply angled and strongly ascending; exposed culmen 4/5 of the length of the head; dertrum about ½ the length of the exposed culmen; and tarsus short, only 1¼ times the length of the exposed culmen.

Description.—Wing about 2½ times the length of the tail, 5½ times the length of the exposed culmen, and 4½ times the length of the tarsus; tail rounded, 2 1/3 times the length of the exposed culmen, and about 2 times the length of the tarsus; bill long but stout, the tip much expanded vertically, the gonys sharply angled and strongly ascending; exposed culmen 4/5 of the length of the head, 3½ times the height of bill at base, and four times its breadth at loral feathering; dertrum slightly less than ½ the length of the exposed culmen; tarsus 1¼ times the length of the exposed culmen, and 1½ times the

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length of middle toe without claw; bare portion of tibia about 9/10 of the length of middle toe without claw

Type.—Charadrius obscurus Gmelin.

Remarks.—In its stout bill with turgid tip and in its short tarsus this monotypic genus is very different from both *Eupoda* and *Pernettyva,* and forms therefore an excellent generic group. The name *Hyetoceryx* Heine[1] is merely a substitute name for *Pluviorhynchus* Bonaparte on grounds of purism.

The only species of this genus is:

Pluviorhynchus obscurus (Gmelin).

Pagoa Mathews.

Pagoa Mathews, Birds Australia, III, pt. 1, April 2, 1913, p. 82, figs. 1 and 4 (p. 83) (type, by original designation and monotypy, *Charadrius geoffroyi* Wagler [= *Charadrius leschenaultii* Lesson]).

Diagnosis.—Similar to *Pluviorhynchus,* but wing 6 times the length of the exposed culmen, and 3¾ times the length of the tarsus; tail 1½ times the length of the tarsus; tarsus 1¾ times the length of the exposed culmen, and 2 times the length of the middle toe without claw.

Description.—Wing 2½—2 2/3 times the length of the tail, about 6 times the length of the exposed culmen, and 3¾ times the length of the tarsus; tail square, the two middle rectrices projecting beyond the rest; tail about 2½ times the length of the exposed culmen, and 1½ times the length of the tarsus; bill long and stout, its tip much expanded vertically, the gonys conspicuously angled and strongly ascending; exposed culmen 4/5 of the length of the head, 3¼ times height of bill at base, 4 times its breadth at the loral feathering, and longer than the middle toe with claw; dertrum ½ the length of the exposed culmen; tarsus 1¾ times the length of the exposed culmen, and 2 times the length of middle toe without claw; bare portion of tibia equal to the middle toe without claw.

Type.—Charadrius leschenaultii Lesson.

Remarks.—In shape of bill this group is like *Pluviorhynchus,* and differs much as does that genus from *Eupoda* and *Pernettyva.*

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[1] Nomenclator Mus. Hein. Ornith., 1890, p. 336.

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The name of the type species, hitherto known as *Ochthodromus geoffroyi* (Wagler,)[1] is antedated by *Charadrius leschenaulti,* Lesson,[2] as Mr. Mathews has shown.[1] The type and only species of this genus will, therefore, stand as

Pagoa leschenaultii (Lesson).

Pagolla Mathews.

Ochthodromus Reichenbach, Natürl. Syst. Vögel, 1852, p. XVIII (type, by original designation and monotypy, *Charadrius wilsonia* Ord) (nec *Ochthedromus* LeConte, Ann. Lyc. Nat. Hist. N. Y., IV, 1848, p. 453 [Coleoptera]).

Pagolla Mathews, Birds Australia, III, pt. 1, April 2, 1913, p. 83 (type, by original designation and monotypy, *Charadrius wilsonia* Ord) (nom. nov. pro *Ochthodromus* Reichenbach, praeoc.)

Diagnosis.—Similar to *Pagoa,* but bill shorter and wider, the exposed culmen only 7/10 of the length of the head, and not longer than the middle toe with claw; and tarsus 1¾ times the middle toe without claw.

Description.—Wing about 2½ times the length of tail, 5½—5 4/5 times the length of exposed culmen, and about 4 times the length of the tarsus; tail rounded or square, about 2½ times the length of the exposed culmen, and about 1 2/3 times the length of the tarsus; bill long but stout, its tip much expanded vertically, the gonys sharply angled and strongly ascending; exposed culmen about 7/10 the length of the head, 3 1/3—3½ times the height of bill at base, 3 1/3 times its breadth at the loral feathering, and shorter than the length of the middle toe ithw claw; dertrum slightly more than½ the length of the exposed culmen; tarsus 1½ times the length of the exposed culmen, and 1¾ times the length of the middle toe without claw; bare portion of tibia 9/10 of the length of the middle toe without claw.

Type.—Charadrius wilsonia Ord.

Remarks.—In rostral characters this genus is like *Pagoa* and *Pluviorhynchus,* differing in this respect, as do the two last

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[1] *Ch* [*aradrius*]. *Geoffroyi* Wagler, Syst. Avium, 1827, *Charadrius,* No. 19, p. 61 (Pondichery, India; and Java).

[2] Dict. Sci. Nat., XLII, 1826, p. 36 (Pondichery, India).

[1] Emu, XVI, July, 1916, p. 34.

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mentioned groups, distinctly from *Eupoda* and *Pernettyva*. From *Pluviorhynchus, Pagolla* differs in having the wing only 4 times the length of the tarsus, the bill relatively wider and only 7/10 the length of the head; the dertrum more than ½ the length of the bill; and the tarsus more than 1¼ times the length of the exposed culmen.

Mr. Mathews has already noted[1] the fact that *Ochthodromus* Reichenbach is preoccupied by *Ochthedromus* LeConte[2] for a genus of Coleoptera; and he has therefore proposed the generic name *Pagolla* for *Charadrius wilsonia* Ord as an "alternative" name in case that *Ochthrodromus* Reichenbach be considered the same as *Ochthedromus* LeConte.

The forms of this genus are:

Pagolla wilsonia (Ord).

Pagolla wilsonia rufinucha Ridgway.

Cirrepidesmus Bonaparte.

Cirrepidesmus Bonaparte, Comptes Rendus Acad. Sci., XLIII, No. 8, August 26–31, 1856, p. 417 (type, by tautonymy, *Charadrius pyrrhothorax* Gould [= *Charadrius atrifrons* Wagler]).

Diagnosis.—Similar to *Pagolla*, but wing 8—8½ times the length of exposed culmen; tail 3½ times the length of exposed culmen, but more slender and much less turgid at tip, the gonys less strongly ascending and not sharpely angled; exposed culmen 3/5 of the length of the head; and tarsus 2 times the length of exposed culmen.

Description.—Wing about 2½ times the length of the tail, 8—8½ times the length of the exposed culmen, and 4—4¼ times the length of the tarsus; tail square or rounded, the two middle rectrices projecting beyond the rest, its length about 3½ times the length of the exposed culmen, and 1¾ times the length of the tarsus; bill rather long and slender, the tip only moderately expanded vertically, the gonys not sharpely angled and not very strongly ascending; exposed culmen 3/5 of the length of the head, 3—3/23 times the height of bill at base, and 2¾—3¼ times its breadth at loral feathering; dertrum ½—11/20 of the length of the exposed culmen; tarsus 2 times

[1] Mathews, Novit. Zool., XVIII. No. 1, June 17, 1911, p. 5.
[2] Ann. Lyc. Nat. Hist., N. Y., IV, 1848, p. 453.

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the length of the exposed culmen, and 1 4/5—2 times the length of the middle toe without claw; bare portion of tibia equal to the middle toe without claw, or only 4/5 as long.

Type.—*Charadrius atrifrons* Wagler.

Remarks.—From *Pluviorhynchus, Pagoa,* and *Pagolla* the present group is easily distinguishable by its bill alone, which is weaker with a much less swollen tip; and *Cirrepidesmus* is very different otherwise, as a comparison of the above descriptions will readily show. From *Eupoda* it differs in having the wing 8—8½ times the length of the exposed culmen, and 4—4½ times the length of the tarsus; the tail 3½ times the length of the exposed culmen; the bill shorter, broader, and stouter, the exposed culmen only 2 4/5—3¼ times the width of bill at loral feathering; the tip of the bill more turgid; the gonys more ascending; exposed culmen 3/5 of the length of the head; dertrum about ½ the length of the exposed culmen; and tarsus 2 times the length of the middle toe without claw. For the differences distinguishing *Cirrepidesmus* from *Pernettyva* consult the Key to Genera on page —.

While *Charadrius mongolus* Pallas is undoubtedly generically the same as *Charadrius atrifrons* Wagler, it differs slightly in having a relatively shorter and stouter bill.

Mr. Mathews has used the name *Charadrius atrifrons* Wagler[1] for *Charadrius pyrrhothorax* Gould[2] but without giving any reasons therefor or any reference to its place of publication. The two names apparently refer to the same bird, as does also *Charadrius inconspicuus* Wagler[3]. Since *Charadrius atrifrons* Wagler is found to have anteriority it must be used for the species.

The two species referable to this genus are:

Cirrepidesmus atrifrons (Wagler).

Cirrepidesmus mongolus (Pallas).

Charadrius Linnaeus.

Charadrius Linnaeus, Syst. Nat., ed. 10, I, 1758, p. 150 (type, by tautonymy, *Charadrius hiaticula* Linnaeus).

Aegialitis Boie, Isis (von Oken), X, 1822, p. 558. (type by

[1] Isis (von Oken), XVII, 1829, p. 650 (Bengal, India).

[2] Birds Australia, III, pt. 1, April 2, 1913, p. 81.

[3] Isis, XVII, 1829, p. 651. *Cf.* Oberholser, Proc. U. S. Nat. Mus., XXII, April 23, 1900, p. 206.

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subsequent designation [Gray, Cat. Gen. and Subgen. Birds Brit. Mus., 1855, p. 111], *Charadrius hiaticula* Linnaeus).

Diagnosis.—Similar to *Cirrepidesmus*, but wing 2 times the length of the tail, 9 times the length of the exposed culmen, and 5 times the length of the tarsus; tail 4½—4 2/3 times the length of the exposed culmen, and 2½ times the length of the tarsus; bill much shorter, only ½ the length of the head.

Description.—Wing about 2 times the length of the tail, 9 times the length of exposed culmen, and 5 times the length of the tarsus; tail slightly rounded or double emarginate, 4½—4 2/3 times the length of the exposed culmen, and 2½ times the length of the tarsus; bill short but rather slender, the tip only moderately expanded vertically, the gonys not much, if any, angled, and only moderately ascending; exposed culmen about ½ the length of the head, 3 times the height of bill at base, and 3 1/3 times its width at loral feathering; dertrum about half the length of exposed culmen; tarsus 1 4/5 times the length of exposed culmen, and 1 2/3 times the length of the middle toe without claw; bare portion of tibia about 9/10 of the length of middle toe without claw.

Type.—Charadrius hiaticula Linnaeus.

Remarks.—This group is well differentiated fro mthe other genera here treated, but is apparently nearest to *Cirrepidesmus*. Comparison of its characters with those of the other genera may readily be made by consulting the descriptions above given and the Key to Genera on page —.

The name *Charadrius* Linnaeus must be transferred from the golden plovers, to which it has been hitherto applied, because its type has been found to be, by tautonymy, *Charadrius hiaticula* Linnaeus. It thus supplants *Aegialitis* Boie, as already explained by Mr. Mathews.[1]

It has not been possible without more study than I am at present able to devote to the subject to determine what species are now properly referable to this genus.

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[1] Novit. Zool. XVIII, No. 1, June 17, 1911, p. 5.

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THE AMOUNT OF FOOD EATEN BY THE SPIDER, ARANEA SERICATA

CATHERINE ELIZABETH NEBEL.

INTRODUCTION

Though the kind of food that many animals eat has been observed, little is known in general concerning the quantity necessary for metabolism. This is true more or less of all invertebrates and of most vertebrates except the domesticated animals. It is therefore desirable that data be accumulated which will give accurate information on food requirements.

This paper relates to the amount of food eaten by seven spiders (*Aranea sericata* McCook) and the amount gained or lost in weight by the same spiders from October 1, 1915 to January 26, 1916. The spiders were collected in the green-house of the Biology building, University of Wisconsin, on September 30, 1915. The food consisted of fruit flies (*Drosophila ampelophila*) raised on over-ripe bananas, and the spiders were fed daily. The experiments were performed in a north room of the biology building at a fairly constant temperature. Spiders were weighed once a week.

According to McCook ('89) spiders usually seize their prey with the claws of the two fore pairs of legs. These are so long that they can be stretched out well in front of the body and grasp the insect without much danger in case the captured animal attempts to defend itself.

Emerton ('83, 32–38) states that spiders sometimes chew an insect for hours until it becomes a round lump of skin, with all the juices extracted from it. It is then thrown away, the spider only swallowing such bits as may happen to be sucked in with the liquid portions.

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The spiders used in the present experiments were placed separately in eight inch test-tubes which were closed with cotton plugs that were saturated with water daily in order to furnish moisture. A certain number of fruit flies were put into the tubes with each spider every twenty-four hours. The number varied according to the food capacity of the particular spiders. The following day the dried-up skins of the flies eaten and any dead flies, were removed from the tubes, together with any web the spider might have woven.

From January 5 to January 12 no flies were given to the spiders, but the cotton plug in the test tube was moistened daily with water. Although spiders are able to go for a period without food, water is necessary. Once when a spider seemed to be in a very torpid condition, it was revived and became very active when given an abundance of moisture. It will be seen that there was not a very marked increase in the amount of food eaten after this period.

The temperature was varied from time to time and the number of flies eaten was correlated somewhat with such variations.

At a temperature of 19°C the spiders showed an increase in the amount of food eaten on the second day. The same result was again obtained when the same individuals were subjected to a like temperature for one or more days in the following month.

From constant feeding spiders 1, 2, 3, 6, and 7 increased in weight while 5 remained the same and 4 increased for a time and then decreased.

CONCLUSIONS

The fact that spiders are poisonous has led people to believe that they are generally dangerous. Spiders do secrete a poison in the tips of their mouth parts but they usually use this as a means of killing their prey and, if undisturbed, they retain it. The spider, as far as is possible, obscures itself and very seldom goes where it is unwelcome; consequently it can hardly be said to be a pest.

The common house spider is most useful for the destruction of flies and other pests; but most people are ignorant of its

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value. It is usually looked upon as an objectionable visitor and consequently destroyed whenever encountered.

After making counts in representative fields, it was found that there are approximately ten thousand Araneas on an acre of land. Since the average farm in Wisconsin and in the United States is about one hundred and sixty acres, this would mean that there would be about a million spiders.

The experiments described in this paper show that a spider will consume an average of two and one-half fruit flies per day. Assuming that the fly season lasts for six months of the year, the spiders on an average farm will destroy approximately four billion flies per year.

These figures show conclusively that the services of the spider are of great value, for it would be difficult to destroy such an enormous number of flies by artificial means.

That the fly is a very destructive as well as dangerous pest is now a matter of common knowledge. The injury done by this insect may be summarized as follows: It carries disease, aids in the accumulation of filth and dirt in buildings and houses, decreases the milk flow among the cattle, and is generally annoying to the human race.

The value, then, of the spider lies in its ability to catch and destroys flies, which is, indeed, a great service to society. If the spider were not in existence to assist materially in the extermination of the fly, mankind would be seriously handicapped, and no doubt if people in general would realize the great economic importance of the spider, and cooperate with it instead of carrying on a campaign of extermination, dangers from the fly plague would be greatly lessened.

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Description of Experiments

Table I.—*Showing the number of fruit flies eaten daily by seven spiders. One and four were males; two, three, five, six and seven were females.*

Spider	1	2	3	4	5	6	7
Oct. 1	4	4	2	1	4		
Oct. 2	5	5	5	5	1		
Oct. 4	5	4	5	3	3		
Oct. 5	4	6	5	2	1		
Oct. 6	4	6	6	2	0		
Oct. 7	3	4	6	1	2		
Oct. 8	3	2	3	2	2		
Oct. 9	1	3	2	4	3		
Oct. 10	3	0	2	0	1		
Oct. 11	2	1	1	1	3		
Oct. 12	3	3	4	2	1		
Oct. 13	1	0	3	0	0		
Oct. 14	1	1	0	1	0		
Oct. 15	1	2	1	1	0		
Oct. 16	0	3	1	0	0		
Oct. 17	0	1	2	3	0		
Oct. 18	1	0	0	1	0		
Oct. 19	3	1	0	0	0		
Oct. 20	2	1	0	1	0		
Oct. 21	0	0	0	2	0		
Oct. 22	0	0	0	2	0		
Oct. 23	1	1	0	1	0	10	0
Oct. 24	1	1	1	1	1	11	0
Oct. 25	1	1	0	1	0	13	0
Oct. 26	0	0	0	0	0	6	0
Oct. 27	1	0	0	2	0	3	0
Oct. 28	0	0	0	0	0	2	0
Oct. 29	0	1	0	2	0	1	0
Oct. 30	0	2	0	1	0	2	0
Nov. 1	3	7	0	0	0	2	0
Nov. 2	6	8	0	0	0	2	0
Nov. 3	4	9	0	0	0	1	0
Nov. 4	0	5	1	0	0	0	0
Nov. 5	0	2	1	0	0	1	0
Nov. 6	6	3	0	1	0	2	0
Nov. 7	6	7	1	0	0	0	0
Nov. 8	2	0	1	0	0	1	0
Nov. 9	7	5	0	0	0	1	0
Nov. 10	6	12	0	2	0	1	0
Nov. 11	7	8	2	1	0	0	0
Nov. 12	0	1	0	0	0	1	1
Nov. 13	0	7	0	0	0	0	0
Nov. 14	0	3	1	0	0	0	0
Nov. 15	0	0	1	5	0	0	0
Nov. 16	0	0	0	4	0	3	1
Nov. 17	0	7	8	1	1	3	2
Nov. 18	0	0	6	0	0	8	7
Nov. 19	0	2	7	0	0	4	4
Nov. 20	1	0	8	1	0	4	9
Nov. 21	2	0	7	0	1	4	6
Nov. 22	3	0	12	2	0	7	8
Nov. 23	4	0	16	6	0	4	2
Nov. 24	9	0	17	1	0	6	5
Nov. 25	4	0	15	1	0	4	4
Nov. 26	3	0	10	2	0	4	7
Nov. 27	4	0	11	4	1	4	15
Nov. 28	3	0	10	2	0	4	8
Nov. 29	2	0	15	1	0	2	5
Nov. 30	1	2	8	0	0	3	4
Dec. 1	1	2	7	0	0	3	3

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TABLE I—Continued.

Spider	1	2	3	4	5	6	7
Dec. 2	4	6	8	4	0	2	0
Dec. 3	1	5	11	5	0	2	0
Dec. 4	0	3	8	4	0	0	1
Dec. 5	0	3	8	4	0	1	1
Dec. 6	1	13	16	5	0	3	0
Dec. 7	0	4	0*	0	0	1	0
Dec. 8	1	11	1	3	1	0	0†
Dec. 9	7	1	0	8	0	2	.....
Dec. 10	6	9	5	6	1	3	.....
Dec. 11	4	4	2	4	1	2	.....
Dec. 12	3	3	1	4	1	2	.....
Dec. 13	1	0	4	0	8	5	.....
Dec. 14	0	0	3	0	6	3	.....
Dec. 15	5	0	0	0	1	1	.....
Dec. 16	0	0	3	1	1	2	.....
Dec. 17	0	0	3	0	0	2	.....
Dec 18	0	0	2	0	0	1	.....
Dec. 19	0	0	3	2	1	1	.....
Dec. 20	0	0	3	2	1	1	.....
Dec. 21	1	0	4	1	1	2	.....
Dec. 22	2	2	9	10	0	12	.....
Dec. 23	8	2	11	2	0	2	.....
Dec. 24	2	6	8	9	3	14	.....
Dec. 25	1	7	4	6	1	9	.....
Dec. 26	2	6	3	7	2	8	.....
Dec. 27	4	7	3	6	1	9	.....
Dec. 28	4	5	6	2	3	9	.....
Dec. 29	4	6	11	4	2	14	.....
Dec. 30	4	5	12	3	2	10	.....
Dec. 31	5	5	13	3	2	12	.....
Jan. 1	6	6	10	4	2	10	.....
Jan. 2	5	5	8	2	2	9	.....
Jan. 3	4	7	6	3	1	10	.....
Jan. 4	12	5	8	4	2	9	.....
Jan. 5	.....	.....	.....	.....	.....	.....	.....
Jan. 12	.....	.....	.....	.....	.....	.....	.....
Jan. 13	6	0	8	4	0	4	.....
Jan. 14	7	6	11	4	3	5	.....
Jan. 15	6	5	7	2	2	7	.....
Jan. 16	5	5	8	3	1	10	.....
Jan. 17	4	6	6	5	1	8	.....
Jan. 18	6	5	4	4	3	9	.....
Jan. 19	5	7	5	4	2	6	.....

*Laid cocoon of eggs.
†Died at temperature of 35°

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TABLE II—*Showing the weekly average number of fruit flies eaten by seven spiders, from October 1, 1915 to January 26, 1916.*

Spider	1	2	3	4	5	6	7
1st week	28	31	32	16	13	.....	.....
2nd week	12	9	13	9	8	.....	.....
3rd week	6	6	3	9	0	.....	.....
4th week	4	4	1	7	1	46	0
5th week	19	36	2	2	0	9	0
6th week	28	40	4	3	0	4	1
7th week	1	12	31	11	1	22	28
8th week	29	0	88	19	2	33	47
9th week	12	18	67	16	0	26	21
10th week	19	45	32	19	3	12	.....
11th week	18	3	16	5	17	16	.....
12th week	13	17	42	32	7	41	.....
13th week	27	40	58	29	14	72	.....
14th week	Starved						
15th week	39	34	49	26	12	49	.....
.....							
Total	262	312	490	212	82	358	92
Ave. per day....	2.5	3	4.5	2.25	.83	4.5	2.

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TABLE III—*Showing the Number of Fruit Flies Eaten at Different Temperatures.*

Temp.	Date	No. of days	Spider	1	2	3	4	5	6	7
19° C...	Dec. 5	2	No. of flies.....	0	3	8	4	0	1	1
	Dec. 6			1	13	16	5	0	3	0
25° C...	Dec. 7	2	No. of flies.....	0	4	0	0	0	1	0
	Dec. 8			1	11	1	3	1	0	0§
17° C...	Dec. 9	4	No. of flies.....	7	1	0	8	0	2	.....
	Dec. 10			6	9	5	6	1	3	.....
	Jan. 17			4	6	5	5	1	8	.....
	Jan. 18			6	5	4	4	3	9	.....
22° C...	Oct. 4	5	No. of flies.....	5	4	5	3	3	0	.....
	Oct. 6			4	6	6	2	0	0	.....
	Oct. 7			3	4	6	1	2	0	.....
	Dec. 11			4	4	2	4	1	2	.....
	Dec. 12			3	3	1	4	1	2	.....
20° C...	Dec 13	3	No. of flies.	10	0	4	0	8	5	.....
	Dec. 29			4	6	11	4	2	14	.....
	Dec. 30			5	5	12	3	2	10	.....
21° C...	Dec. 14	4	No. of flies.....	5	0	3	0	6	43	.....
	Jan. 13			6	0	8	4	0	4	.....
	Jan. 14			7	6	11	4	3	5	.....
	Jan. 15			6	5	7	2	2	7	.....
5° C...	Nov. 15	7	No. of flies.....	0	0	1	5	0	0	.....
	Nov. 16			0	0	0	4	0	3	.....
	Nov. 17			0	7	8	1	1	3	.....
	Dec. 15			0	0	0	0	1	1	.....
	Dec. 16			0	0	3	1	1	2	.....
	Dec. 17			0	0	3	0	0	2	.....
	Dec. 18			0	0	2	0	0	1	.....
7° C...	Dec. 19	4	No. of flies.....	0	0	3	2	1	1	.....
	Dec. 20			0	0	3	2	1	1	.....
	Dec. 21			0	0	4	1	1	2	.....
	Dec. 22			1	2	9	10	0	12	.....
13° C...	Dec. 25	3	No. of flies.....	2	7	4	6	1	9	2
	Jan. 3			2	7	6	3	1	10	0
	Jan. 4			1	5	8	4	2	9	1
20° C...	Dec. 26	3	No. of flies.....	1	6	3	7	2	8	....
	Dec. 27			2	7	3	6	1	9	....
	Dec. 28			4	5	6	2	3	9	.....

§ Spider died in incubator.

TABLE IV—*Weights of Spiders in Grams.*

Spider	1	2	3	4	5	6	7
Nov. 5.....	.01	.017	.06	.09	.10	.045	.045
Nov. 12.....	.014	.019	.066	.093	.103	.045	.048
Nov. 26.....	.015	.019	.067	.093	.103	.047	.05
Dec. 3.....	.015	.020	.075	.091	.103	.050	.054
Dec. 10.....	.015	.022	.076	.090	.103	.050	.054
Dec. 24.....	.015	.022	.076	.087	.103	.055	.054
Jan. 7.....	.017	.022	.077	.085	.103	.065	.....

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THE VISCERAL ANATOMY OF THE GARTER SNAKE

WILLIAM HENRY ATWOOD

INTRODUCTION

Our information on the visceral anatomy of the Ophida is very limited. Hopkinson and Pancoast ('37) described the visceral anatomy of the Python, and Jaquart ('55) described its circulatory system. Schlemm ('27) studied the circulation of *Tropidonotus natrix* and *Trigonocephalus mutus*. Bronn's Thier Reich ('90) contains a resumé of the work up to the time it was published. Beddard has contributed much to our knowledge of serpent anatomy in his papers published between 1903 and 1909. O'Donoghue ('12) gave an excellent account of the circulation of *Tropidonotus natrix*. Thompson ('13, '14) contributed some valuable notes on a number of species. In 1916 the author described the visceral anatomy of *Zamenis Constrictor*.

The entire blood system of snakes may be injected through the ventricle of the heart. The valves do not prevent the fluid from passing, under pressure, into the atria and hence into the veins. The vena cava should be injected at the anterior end of the liver; the portal vein may be injected at the posterior end of the liver when it is desirable to have two colors in the veins. The injection fluid used in this work was gelatine colored with lead chromate or india ink.

This paper is based on investigations carried on in the Zoological Laboratories at the University of Wisconsin. My thanks are due to Professor A. S. Pearse, who read the manuscript.

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DESCRIPTIONS OF SPECIMENS

Because of the great variability of garter-snakes and the complexity of their classification descriptions have been inserted of the specimens used in this investigation, so that the reader may satisfy himself as to the affinities of the types dissected.

The principal characters which are of value in classification are given in Table I. The two specimens from Granite City, Illinois, were of a dark olive-brown color. No. 1 showed much red on the sides between the black spots. No. 2 showed no red at all; otherwise they were alike. I judge these specimens to be *Thamnophis sirtalis*. The red on the sides of No. 1 indicates that it belonged to the subspecies of *T. sirtalis parietalis*.

Specimen No. 3 from Holland, Michigan, was of a chestnut brown color with a small amount of red on the sides (*T. sirtalis parietalis*); the dorsal stripe was obscure and the belly color was continuous with, and the same as, the color of the lateral stripe covering the first scale row. (*T. sirtalis pallidula*). Although *T. sirtalis parietalis* is not reported east of the Mississippi River the writer has frequently seen specimens having the characteristic red color near Granite City, Illinois, and at Holland, Michigan.

The specimens from Madison, Wisconsin, are difficult to classify. They all look alike excepting No. 9 but on close investigation they seem to fall into different groups.

TABLE I — *Showing general points about the garter-snakes studied.*

Number	Locality	Dorsals	Supra-labials	Infra-labials	Ventrals	Caudals	Body length	Tail length	Lateral stripe	Sex
1	Granite, Ill.	19-17	7	11	152	66	25.50	7.50	2, 3	F
2	" "	19-17	7	11	150	....	33.	...	2, 3	F
3	Holland, Mich.	19-17	7	9	146	63	16.	4.50	1, 2, 3	F
4	Madison, Wis.	19-19	7	10	149	74	16.	5.	3 (4)	M
5	" "	19-17	7	10	155	79	14.50	4.75	2, 3	M
6	" "	19-21	7	11	154	71	15.50	4.50	2, 3	F
7	" "	21-19-17	7	10	151	63	16.50	4.	3, 4	F
8	" "	17-19	7	10	162	67	21.	5.75	2, 3	F
9	" "	17-19-21	7-8	10	157	70	13.65	3.75	(1) 3 (4)	F
10	" "	19-17	7	10	155	63	18.75	4.75	1, 2, 3	F
11	Marion Co.	19-17-15	7	9	150	...	22.50	.....	2, 3	F
12	" "	21-19-17	7	10	145	60	28.	7.50	2, 3	F
13	" Fla.	19-17	7	10	144	70	23.	6.75	2, 3	F
14	" "	19-17	7	10	143	68	20.50	6.	2, 3	F
15	" "	19-17	7	10	135	71	22.50	6.50	2, 3	F
16	" "	19-17	7	10	145	....	22.50	.....	2, 3	F
17	" "	19-17	6-7	10	142	67	27.	7.50	2, 3	F
18	" "	19-17-15	7-8	10-11	158	...	22.50	.....	3 (4)	F

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I believe that the forms with the lateral line on the second and third scale rows and those with the lateral line on the third and fourth scale rows (*T. radix* and *T. sirtalis*) are interbreeding in this locality. No. 4 and No. 7 have the lateral stripe in the third and fourth scale rows (*T. radix*). No. 9 has the lateral stripe on the third row and some color on the second and fourth rows. This suggests *T. butleri,* but the scutellation has not been reduced enough to fit that species. The sides of this specimen were marked with two rows of black spots divided by yellow. The yellow also appeared on the scales slightly. I therefore judge this specimen to represent the yellow phase of *T. sirtalis parietalis* although it differs from the type specimen and its known range does not include this locality. Nos. 6 and 8 were very much alike *(T. sirtalis).* In No. 10 *(T. sirtalis)* the stripes were all very broad, those on the sides covering the first scale row. The specimens from Marion County, Florida, (Nos. 11, 12, 13, 14, 15, 16, 17,—*T. sirtalis*) were alike in color, having prominent black spots on a light blue background. Specimen No. 18 from Marion County Florida, was a typical *T. sauritus sackeni.*

Circulatory System.

The Arteries of the Neck.

Three arteries leave the right aortic arch to supply the body anterior to the heart. The left *carotid* artery lies dorsal to the left jugular vein and ventral to the esophagus; supplies the left thymus gland, the thyroid gland, the fat body, the esophagus, the trachea and the head. Its branches are all very small and variable in the neck region.

The right carotid artery has been reduced to the small *thyroid artery* of O'Donoghue ('12) (*ramus glandularis* of Brown, '90). It supplies the thyroid gland and in some specimens sends a large branch to the esophagus. This esophagaegal branch passed dorsal to the heart and ran caudalward along the ventral wall of the esophagus, (Fig. 1). It was found by the writer ('16) in *Zamenis constrictor* and its root was figured but its course could not be fully traced, hence it was not described. I do not know that it has been mentioned before or that it exists in all specimens of the species herein considered. Twigs from the thyroid

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artery to the right thymus gland were made out in only three specimens and were exceedingly small.

The glands of this region become very small during starvation. In some specimens the thyroid became colorless and transparent. The fact that the fat body of the neck had been entirely absorbed and that the neck glands had been so much reduced may account for the smallness of the blood vessels in this region. It is noted elsewhere in this paper that the veins of the oviducts are larger while the oviducts are filled with eggs. It seems that the size of the blood vessels varies somewhat with their activity.

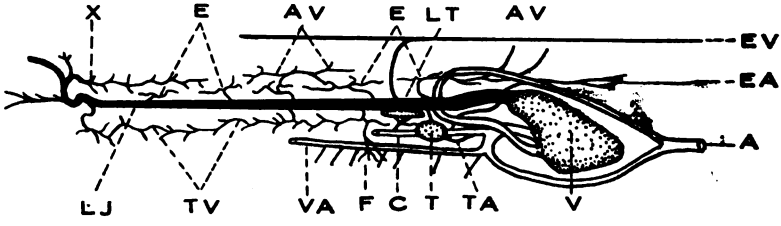

FIG. 1.

The left jugular vein. A, aorta; AV, X, remains of the left azygous vein; C, carotid artery; E, esophageal veins; EA, esophageal artery from thyroid artery; EV, epigastric vein; F, vein from fat body; LT, left thymus gland; RJ, right jugular vein; T, thyroid gland; TA, thyroid artery; TV, tracheal vein; V, ventricle; VA, vertebral artery.

The *vertebral artery* leaves the right aortic arch and runs forward about half way to the head before passing into the mid-line of the dorsal parietes. In two specimens it sent eight branches to the mid-line of the dorsal parietes; in one specimen seven; in eight specimens six; in five specimens five; and in one specimen only three. These variations were apparently not correlated with variations in the external anatomy. The twigs from the vertebral artery to the esophagus were very small. Six were counted in one specimen. In some specimens they could not be made out at all.

The Dorsal Aorta and Its Branches

As in other snakes the aorta originates just posterior to the heart from the junction of the two aortic arches, (Fig. 1). In the eighteen specimens examined the right arch gave off one or two intercostals to the mid-line of the dorsal parietes before unit-

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ing with the left arch. The left arch is larger than the right and gives off no branches to the parietes.

The branches from the aorta to the dorsal parietes in fourteen specimens examined varied from forty-three to eighty. Table II shows the total number of rib-bearing vertebra in the first column, the total number of inter-costals from the junction of the two aortic arches to the anus in the second column and the number of vertebrae between the first aortic branch and the anus in the third column. It will be seen that in specimen No. eighteen (*T. sauritus sackeni*) the aortic branches begin farther back than in any other specimen. This individual has a longer neck and the heart is placed farther back than in the specimens of *T. sirtalis.*

TABLE II—*Showing the Relation of the Intercostal Arteries to the Rib-bearing Vertebrae.*

Specimen	Rib-bearing vertebrae	Intercostals	Intercostal spaces covered
1	151	55	120
2	146	80	122
6	146	46	119
7	149	54	118
8	155	74	124
9	149	71	122
10	142	51	114
11	151	54	123
12	142	50	113
14	139	54	115
15	142	55	114
16	142	61	112
17	141	44	110
18	145	43	102

All of the intercostal arteries enter the mid-line of the dorsal parietes and are not paired.* In the *Boidae* these intercostal arteries are paired and enter to the left and right of the mid-line of the dorsal parietes. (Beddard, '04, '06, '08). In the *Colubridae* these conditions vary and may prove to be of great importance in classification.

The branches of the aorta to the liver and esophagus are small, numerous, and variable. *The lieno-gastric artery* runs to the region of the pyloric end of the stomach to supply the stomach.

*One abnormal pair was found but both its branches entered the mid-line of the dorsal parietes.

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O'Donoghue ('12) describes this artery in *Tropidonotus natrix* as supplying the spleen and gall bladder also. In *Zamenis constrictor* this artery was figured and described by the writer ('16). It supplies the stomach, gall bladder, spleen, pancreas and fat body.

The *superior mesenteric artery* leaves the aorta a short distance posterior to the pancreas and sends a large anterior branch to the region of this organ. The branch supplies the stomach, duodenum, spleen, pancreas and fat body. It probably supplies the gall bladder also, but I could not be certain in any case. The posterior branch of the superior mesenteric artery follows the intestine and forms a junction with the first inferior mesenteric artery.

The aorta gives off one branch to each of the adrenal bodies. These arteries send variable branches to the ovaries or testes, the oviducts or sperm ducts, and to the fat bodies.

Between the adrenal bodies and the kidneys of each side arteries pass from the aorta, down to the oviducts or fat bodies or both. They could not always be found and did not exceed three in number in any case. The most posterior one may be connected with the anterior renal artery which often supplies the fat body or oviduct.

The *renal arteries* vary from three to six. Any one of them may be connected with the oviduct or fat body.

The Right Jugular Vein.

The right jugular vein receives blood from the following organs: trachea, esophagus, right thymus gland, thyroid gland, fat body, epigastric vein, tongue muscles, and head, (Fig. 2). It does not receive any blood from the right dorsal parietes except through the azygous veins. The anterior branch of the *azygous vein* extends forward to the head, receiving branches from the right dorsal parietes and the esophagus. The branches from the esophagus form a reticulation on the esophagus and send branches off to the left which enter the right jugular vein; so the anterior azygous and right jugular veins are connected by this reticulation. The *posterior azygous* vein differs greatly. It may consist of three large trunks from the right parietes in its maximum condition or may be reduced to a medium sized trunk

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entering the anterior azygous vein just before it enters the rigth jugular vein.

The azygous veins of different species of serpents differ greatly and in the writer's estimation might well be used in classification.

The branches from the *epigastric vein* to the right jugular vein varied from three to seven in eighteen specimens examined. They averaged four. The epigastric vein in *Thamnophis* is more continuous in the neck region than in *Zamenis constrictor* (Atwood, '16), and has fewer connections with the right jugular vein.

The *esophageal vein* of O'Donoghue ('12) could not be found in *Thamnophis*.

The Left Jugular Vein.

The *left jugular vein* originates in the head and courses along the left ventral surface of the esophagus to the heart. It passes ventral and to the left of the left atrium and traverses the dorsal surface of the heart, from left to right, between the left atrium and the ventricle to enter the right atrium through the sinus venosus together with the vena cava and the right jugular vein. It is nearly as large as the right jugular vein.

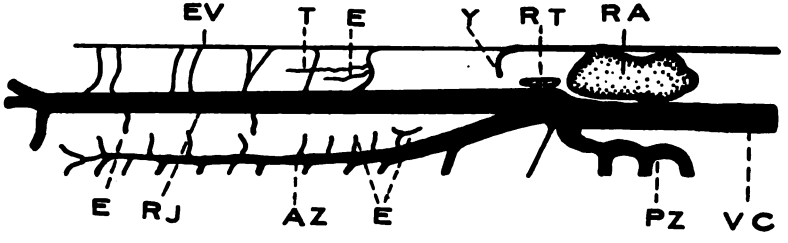

FIG. 2.

The right jugular vein. AZ, right azygous vein; E, esophageal veins; EV, epigastric vein; PZ, posterior azygous vein; RA, right atrium; RJ, right jugular vein; RT, right thymus gland; T, vein from tongue muscles; VC, vena cava; Y, branch from the epigastric vein to the left jugular.

The first branch of the left jugular vein is received just before it enters the pericardium of the heart near the anterior end of the left atrium. It carries blood from the esophagus and is the first of a series of veins, which differ in number, from the esophagus to the left jugular vein. This series begins in the region of the heart and extends throughout the length of the

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vein. On the left surface of the esophagus the veins of this series are broken up into small tracts which reassemble and form trunks from the left dorsal parietes. Only one large vein leads directly from the left dorsal parietes to the left jugular vein, (Fig. 1-x). It is quite uniform and runs along the body wall, as does the right anterior azygous vein (Fig. 2), but carries blood forward and empties into the left jugular at the angle of the jaw. This vein does not seem to have been mentioned before and does not exist in *Zamenis constrictor* (Atwood, '16).

There is a tendency for the parietal veins to form a small azygous trunk (Fig. 1, AV) posterior to the termination of the vein mentioned above, but such a condition is not uniform. This suggests the remains of the left anterior azygous vein.

In the region of the heart three, or less, veins leave the left, dorsal parietes and join the reticulation of veins on the left surface of the esophagus then assemble to form the first trunk which enters the left jugular vein (Fig. 1). These parietal veins are variable and are the remains of the left posterior azygeous vein. *Zamenis* differs from *Thamnophis* in that the veins from the left and right parietes do not form a finely divided reticulum on the esophagus but enter the jugular veins more directly (Atwood, '16).

On the ventral surface of the trachea, between the two jugular veins a longitudinal trunk occurs (Fig. 1). It receives blood from the trachea and is connected with the jugular veins and the fat body. The blood leaving the trachea has probably been more or less aerated in its walls.

The connections between the left jugular vein and the epigastric are described along with the epigastric vein.

The left jugular vein receives blood from the following sources: head, esophagus, left dorsal parietes, trachea, fat body, left thymus gland, thyroid gland and epigastric vein.

The Afferent Renal Veins.

The *caudal vein* runs parallel to, and in close contact with, the caudal artery—both lying in the haemal canal of the tail. Above the anus the caudal vein divides to form two trunks, the right and left *afferent renal veins; (illiac veins,* Cope, '00; *venae renalis advehens,* Schlemm, '27; renal portal veins, O'Donoghue, '12). From a position dorsal to the anus these

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veins course forward along the sides of the cloaca and pass along the ventral edges of the kidneys to their anterior end, but do not pass beyond this point as they do in the *Boidae* (Beddard, '04, '06, '08). As in other snakes these veins receive blood from the region of the anus and vagina, sperm ducts or oviducts, epigastric vein and from the dorsal parietes. The connections between the afferent renal veins and the vein of the fat body are not prominent and could not be made out. The *iliac veins* are very prominent in Thamnophis. They carry blood from the body wall on either side of the anus to the afferent renal veins. They have no connection with the abdominal or epigastric veins. They were described in *Tropidonotus natrix* by O'Donoghue ('12) as the *pelvic veins*, and in *Zamenis constrictor* by the writer ('16).

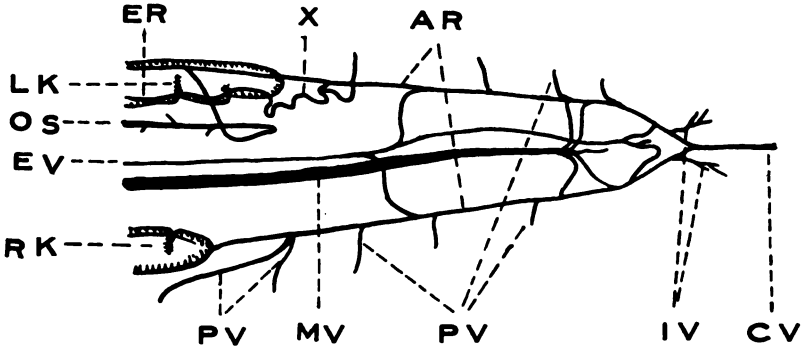

FIG. 3.

The afferent renal veins. AR, afferent renal veins; CV, caudal vein; ER, efferent renal vein; EV, epigastric vein; IV, illiac veins; LK, left kidney; MV, mesenteric vein; OS, oviducal sinus; PV, parietal veins; RK, right kidney; X, abnormal connection between the efferent and afferent renal veins.

In the specimens observed from three to five veins leave the dorsal parietes of each side and enter the afferent renal veins before they reach the kidneys. In specimen No. 1 a vein from the parietes of the left side entered the afferent renal vein of that side just posterior to the kidney. Just before this parietal vein entered the afferent renal vein it gave off a large branch which entered the efferent renal vein. Thus permitting the blood to pass from the afferent renal vein to the efferent renal vein directly, without first passing through the kidney, (Figs. 3, 4). A similar condition was observed on the right side in

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two other specimens. The above conditions probably represent persisting connections between the subcardinals and the post cardinals which were not broken down when the blood from the caudal vein ceased flowing through the kidneys by way of the subcardinals and began to flow by way of the post cardinals before they broke down anterior to the kidneys.

In specimen No. 2 a parietal vein entered the efferent renal vein in the mid-kidney region. This is undoubtedly an abnormal case as veins in this position have not been described in the Ophidia and were not found in any other specimen. It is probably a persisting connection between the subcardinal veins and the parietes.

One large branch leaves the afferent renal vein and becomes the *oviducal sinus*. Blood may flow through this from the caudal vein to the heart by way of the vena cava without passing through any portal capillaries (Fig. 4).

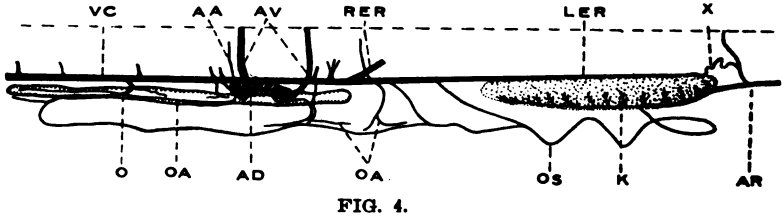

FIG. 4.

The left oviducal sinus, from the left side. AA, adrenal artery; AD, left adrenal body; AR, afferent renal vein; AV, adrenal portal veins; K, kidney; LER, left efferent renal vein; O, ovary; OA, ovarian arteries; OS, oviducal sinus; RER, right efferent renal; VC, vena cava; X, abnormal connection between the efferent and the afferent renal veins.

The origin of the *inferior mesenteric vein* from the afferent renal veins is described in connection with the portal vein.

The Vena Cava

The *vena cava* originates from the junction of the two efferent renal veins near the anterior end of the right kidney and runs forward to the heart. It may receive blood from the caudal vein by any one of the following routes: (1) through the kidneys, (2) by way of the oviducal sinus, (3) by an occasional direct connection between the afferent and efferent renal veins, (Figs. 3, 4).

The vena cava receives blood from the parietes by way of the adrenal bodies. From one to three veins leave the dorsal

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parietes of either side, take their way in the mesentery of the ovary for a short distance, and then enter the adrenal bodies; or they may enter the adrenal bodies direct. They often receive branches from the longitudinal vein of the oviduct before entering the adrenal body. This adrenal portal system has been mentioned as existing in several snakes and is probably present in all members of the order. (Ecker, '46; Gratiolet, '53; Beddard, '04; Atwood, '16).

From eight to twelve veins enter the vena cava from the ovaries and oviducts between the kidneys and the liver, some entering posterior to the adrenal bodies. These veins all connect the vena cava with a long sinus in each oviduct, which originates from the afferent renal vein of the same side and runs along the oviduct to the anterior end where it enters the vena cava, (Fig. 4). This *oviducal sinus* was first described by O'Donoghue ('12) in *Tropidonotus natrix*. It is not prominent except when the oviducts are filled with developing eggs. This probably accounts for the fact that it has been overlooked until recently.

The region between the adrenal bodies and the liver is drained by the portal vein. The vena cava receives no branches in this region except from the structures connected with reproduction. It passes along the ventral surface of the liver on its way to the sinus venosus, receiving blood through the capillaries of the liver from the portal vein, the dorsal parietes, the epigastric vein, the stomach and esophagus. All of the blood from the posterior part of the body enters the heart through the vena cava except that from the lungs.

The Portal Vein

The *portal vein* originates as the *inferior mesenteric* vein from the rectum and from branches from the right and left afferent renal veins. This vein runs along the intestine, but does not follow its folds very closely. After its origin the mesenteric vein receives no branches other than those from the intestine until it is joined by the *abdominal vein* of the fat body. These two veins are of about equal size and unite about one inch caudal to the pancreas.

In the specimens examined no veins from the parietes entered the portal vein posterior to the pancreas as is the case in *Zamenis*

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constrictor, (Atwood, '16). Between the pancreas and the anterior termination of the portal vein branches from the parietes are received both before the vein reaches the liver and along its course in the dorsal surface of the liver. These veins vary from five to ten in number; four of the specimens examined having only five, three having ten, and others varying between these limits.

The veins of this series which enter the portal vein near the anterior end of the liver come from the left dorsal parietes while those which enter the portal vein more posteriorly have a tendency to come from the right. This is also true for *Zamenis constrictor,* (Atwood, '16), and of *Tropidonotus natrix,* (O'Donoghue, '12).

Numerous veins enter the portal from the esophagus. They lie in the mesentery which connects the liver and the alimentary tract. The most anterior of these runs far forward as the continuation of the portal. It carries blood from the esophagus but does not reach the heart. This vein has been variously described in other snakes, (Beddard, '04; Cope, '00; Atwood, '16). It is absent in *Tropidonotus natrix* (O'Donoghue, '12).

The Epigastric Vein

The epigastric vein originates just anterior to the anus and extends forward in the muscles of the ventral body wall to near the head. Above the center of each gastrostege it receives a branch from the lateral body wall of each side. It is single throughout its entire length excepting where it is divided in some specimens by the scar of the umbilicus, where it is double. This indicates that it was double originally.

Normally the epigastric vein receives one or two branches from each afferent renel vein in the vicinity of the cloaca. These may be connected with the oviducts or vagina.

Between the posterior kidney region and the pancreas the epigastric vein is connected with the vein of the fat body by from eight to fourteen veins in the specimens examined. The most anterior of these originated far forward of its connection with the epigastric vein. This indicates that in this genus the pancreas now lies farther forward than formerly.

In the short space between the pancreas and the liver from

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one to three veins enter the portal from the epigastric vein. They are usually connected with the fat body and the intestine.

Along the liver branches from the epigastric vein enter the tissue of the liver to the left of the vena cava but do not enter this vein. These varied in number from four in No. 3 and No. 4 to thirteen in No. 7.

At the anterior end of the liver the portal vein is continued forward and receives blood from the intestine and also from the epigastric vein by a large branch which may be absent.

Anterior to the heart a large vein enters the left jugular from the epigastric. It was present in all specimens excepting No. 4. In Nos. 6, 9 and 18, it occurred as two veins, and No. 11 had three separate veins about a half inch apart (Fig. 1). The fact that this vein varies greatly in the garter-snake agrees with conditions found to exist in *Zamenis constrictor*, (Atwood, '16).

The connections of the epigastric vein in the neck region have been described in the discussion of the right jugular vein.

The Respiratory System

The right lung originates dorsal to the heart and lies in the right, dorsal part of the body-cavity. It extends beyond the caudal end of the liver nearly to the anterior adrenal body in the specimens from Illinois, Michigan, and Wisconsin. In the specimens from Florida it is longer, reaching beyond the anterior adrenal in all cases and to the mid-kidney region in some. In all of the females from Illinois, Michigan and Wisconsin the lung was less than half the length of the body without the tail. In the specimens from Florida the lung was more than half the length of the body. In one male from Wisconsin the lung-length was slightly more than half the body-length.

Although this difference in the length of the lung seems to be quite pronounced and constant I do not consider it of specific significance. It is probably correlated with a more rapid metabolism due to higher temperature.

The left lung is small and rounded but functional, and is connected with the trachea by a pore one sixteenth of an inch anterior to the termination of the tracheal tube in the tissue of the right lung. It is situated to the left of the pulmonary vein.

The alveolar tissue of the trachea begins gradually near the head and becomes more and more prominent until the lung is

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reached where it becomes confluent with the lung tissue on the right side of the trachea.

To the right of the junction of the trachea and the lung an anterior projection of the lung receives along its ventral surface the *pulmonary artery.* Thompson ('14) describes this projection in *Thamnophis ordionoides* as entering the lung through a constriction but no such constriction was found in the specimens examined by me.

The *pulmonary vein* enters the lung to the left of the pulmonary artery and is embedded in the tissue of the lining of the lung on the ventral side while the artery runs along the external, ventral surface of the lung. This is a general condition in the snakes with one lung.

The vascular lining of the lung decreases gradually toward the caudal end so that all but the first two or three inches is little more than an air reservoir.

Opposite the pancreas blood vessels were found on the surface of the lung-sack in the specimens of *T. sirtalis* from Florida. In specimen No. 11 they were especially prominent and of large size. They seemed to be connected in a reticulation and entered the portal vein through at least three trunks, and the vena cava through one. I consider this condition to be very unique and therefore was very careful to make sure that my observations were correct.

The Visceral Organs.

The Alimentary Canal.

The alimentary canal of *Thamnophis* differs but little from that of other serpents. The esophagus and stomach are continuous and are not differentiated. The stomach folds begin in the esophagus and become more and more complex and extensive as the stomach region is reached. The stomach folds are thrown into more complex transverse convolutions than are those of *Zamenis* as judged by preserved specimens. The stomach proper is also shorter than in *Zamenis* (Atwood, '16).

The pyloric end of the stomach is reduced to a small tube lined with comparatively simple, longitudinal folds. It is very short and joins the bluntly rounded stomach proper so that the transition is distinct. The pyloric valve is simply a constriction of

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the food tube lined with small longitudinal folds which project into the duodenum.

The folds of the lining of the small intestine are very complex in the duodenum and decrease gradually toward the rectum. They do not differ materially from those of the lining of the intestine in other snakes.

The diameter of the tube is greatest in the duodenum and decreases gradually toward the anterior kidney region where it reaches its smallest diameter, again increasing toward the rectum. The intestine becomes very large just anterior to its connection with the rectum. There is a constriction at the junction which gives the intestine the appearance of ending in a caecum.

The lining of the rectum is soft, whereas the outer wall of the rectum is more rigid and comparatively harder. The lining of the rectum is a membrane with great surface exposed and is extensively folded in order to accommodate itself to the inside of the rectal tube.

The Liver.

The left lobe of the liver usually extends beyond the right, along the vena cava, both anteriorly and posteriorly, but the posterior ends of the two lobes are sometimes equal. In large specimens of *T. sirtalis* the liver originates about a half inch posterior to the heart. In the specimen of *T. sauritus sackeni* the liver began farther back and was very slender.

The vena cava is embedded in the ventral surface of the liver in all snakes and not in the "superior" surface as stated by Cope ('00). The portal vein is embedded in the dorsal surface. The two veins thus divide the liver into two lobes.

A large scar occurs on the ventral surface of the left lobe to the left of the vena cava and near the anterior end. It is the same scar which occurs in *Zamenis constrictor* and *Z. flagelliformis* and has been described (Atwood, '16) as the remains of the umbilical vein. Beddard ('06) has described the persistent umbilical vein in *Boa* and *Python regius* as connected with the vena cava direct.

The liver receives arterial blood from the aorta through many hepatic arteries which are also connected with the esophagus. It receives venous blood from the portal vein, the epigastric vein, the dorsal parietes and the alimentary canal opposite the liver.

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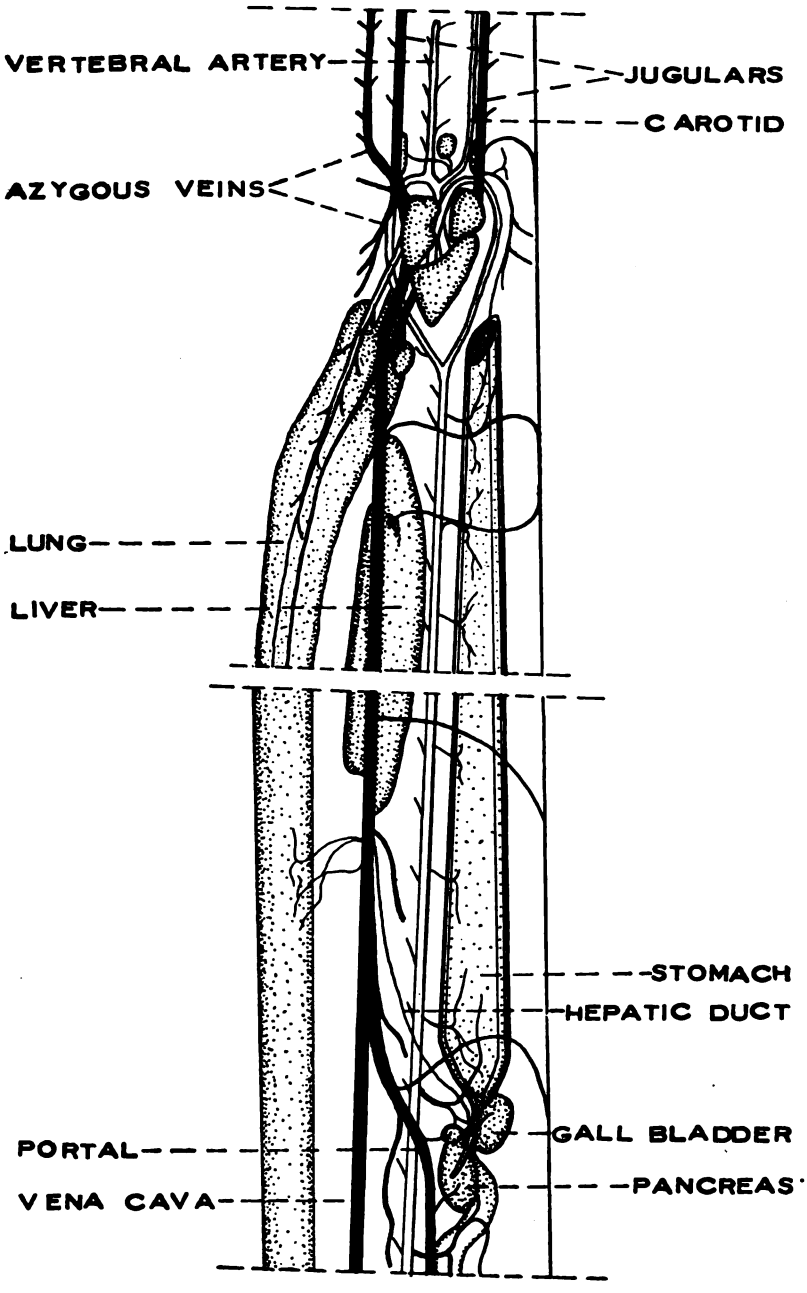

FIG. 5. Ventral view of the viscera.

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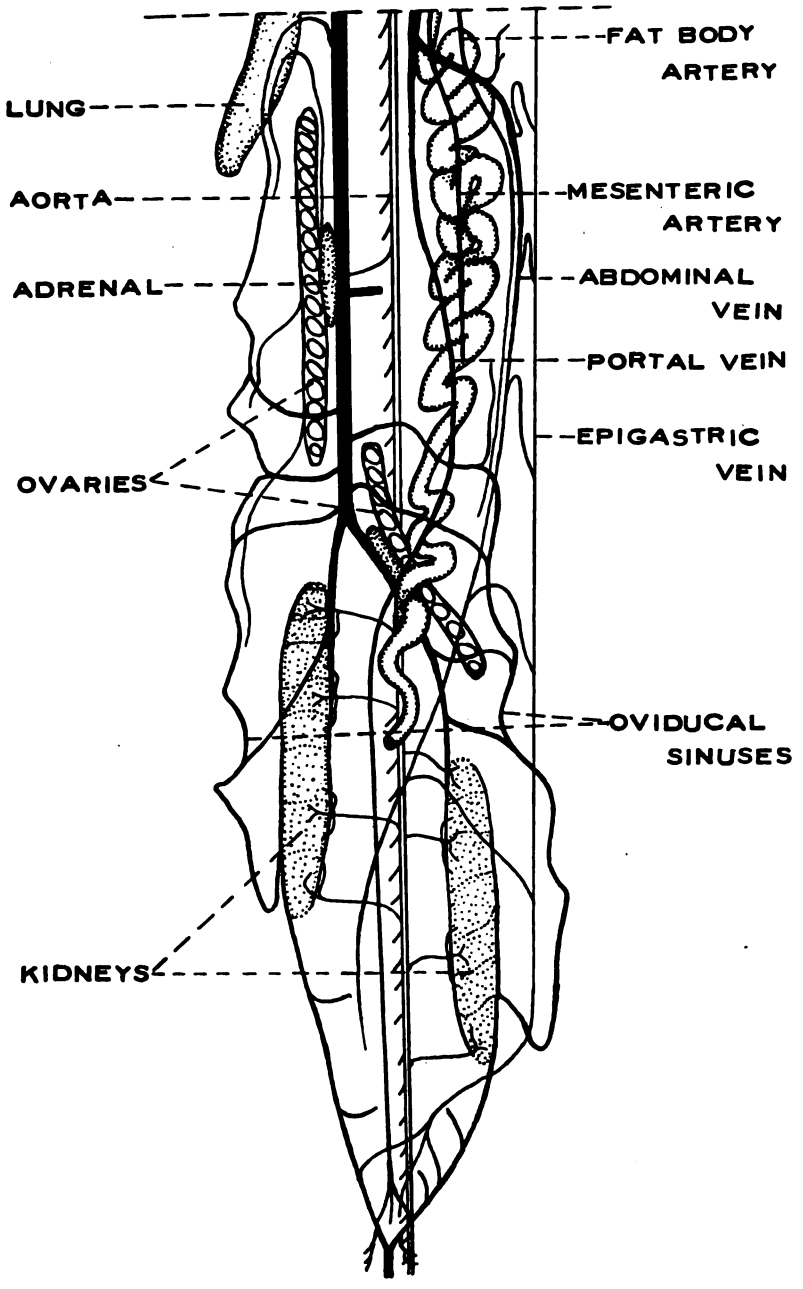

FIG. 5B

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These veins from the alimentary canal are numerous and difficult to count. All blood leaves the liver through the vena cava. These conditions are general for serpents.

The Pancreas.

The pancreas is large and creamy white in color. It is about a half inch long in large specimens and is a little longer than wide. It lies at the anterior end of the duodenum but is not attached to it except where the ducts pass from the pancreas to the intestine. In specimens that are well filled with eggs the pancreas is crowded up close to the liver but in males and females without eggs it lies farther back.

The fact that the veins from the parietes which enter the portal vein anterior to the pancreas run far forward from their origin in the body-wall in order to reach the portal vein anterior to the pancreas suggests that the pancreas once occupied a more posterior position.

The Spleen.

The spleen is of a dark red-brown or chocolate color. It is nearly spherical and attached to the anterior end of the pancreas. It is not fastened to the intestine.

The Fat Bodies.

The two fat bodies of the abdomen extend caudally to a point about opposite the posterior ends of the kidneys. The right one extends caphalad to just beyond the gall bladder while the left reaches about one inch anterior to the caudal end of the liver in large specimens.

Each body consists of a long, much folded strip of white, adipose tissue well supplied with blood vessels.

The fat body of the neck is single and extends from the heart forward about half the distance to the head. It is a thick, solid mass of white adipose tissue. The posterior end is large and blunt, while the anterior end tapers to a point toward the head.

During starvation the fat bodies may entirely disappear leaving only the blood vessels and connective tissues.

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The Ovaries and Adrenal Bodies.

The ovaries vary in position with the adrenal bodies. The right adrenal body lies along the vena cava but the left usually lies along the left efferent renal vein. In three specimens it was situated at the anterior end of this vein and came in contact with the vena cava. In specimen No. 1 the left adrenal body lay wholly along the vena cava a half inch anterior to the junction of the efferent renal veins.

As in other snakes the ovaries are attached by the mesentery to the adrenal bodies and are very closely associated with them. The oviducts extend anterior to the ovaries and when filled with eggs are very large. The left oviduct is short and contains a smaller number of eggs than the right. The right oviduct when filled with eggs extends forward to the pancreas and crowds this organ up close to the liver. The total number of eggs in the right oviducts of seven large specimens was 101, in the left oviducts there were 51. This would indicate that the capacity of the right oviduct is twice that of the left, and gives an average of 21.7 eggs per snake. The largest of these specimens measured 34.5 inches in total length and contained 33 eggs.

The Kidneys.

The kidneys of *Thamnophis* are like those of other snakes in most particulars. They are very deeply lobed. The right kidney often extends beyond the junction of the efferent renal veins. When it does it sends blood into the vena cava through one or more small twigs. In nine specimens which varied in body length from 22 inches to 28 inches, averaging 23.8 inches, the kidneys averaged three inches in length. In the specimen of *T. sauritus sackeni,* which measured 22.5 inches in body length, the right kidney measured 1.4 inches, the left 1.25 inches. If the kidneys in this specimen were normal there is considerable difference in the size of the kidneys in the two species.

Discussion.

The blood system of *Thamnophis* is very similar to that of *Tropidonotus natrix* as described by O'Donoghue ('12). This tends to confirm the belief that the two genera are very closely related.

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The genus *Thamnophis* differs from *Zamenis* in that the intercostal arteries plunge into the mid-line of the dorsal parietes and are not paired, while in *Zamenis* they enter to the left or right and are frequently paired (Atwood, '16). In the Boidae (Beddard, '04, '06, '08, '09), the condition of the intercostals varies but they do not enter the mid-line of the dorsal parietes and are usually paired. In their primitive condition it is probable that a pair entered each intercostal space and in the specialized forms reduction has taken place. If this assumption is true *Thamnophis* is rather highly specialized in this respect.

In regard to the right anterior azygous vein *Thamnophis* and *Tropidonotus* (O'Donoghue, '12) stand rather low in the scale of specialization.

The writer ('16) has mentioned finding many trematodes and nematodes in the viscera of *Zamenis constrictor*. Very few of these were found in *Thamnophis*. This comparative immunity may be a factor in the relative abundance of the garter-snakes.

The writer ('16) has previously commented upon the great individual variability of snakes and the advisability of examining many specimens before making statements. Much of the work on the anatomy of the Serpentes is based on the examination of only one or two specimens.

Thompson ('14) gives some notes on the visceral anatomy of one specimen of *T. ordinoides*. His description does not indicate that it differs specifically from the specimens of *T. sirtalis* described in this paper. He states that the maximum number of dorsal scale rows in this species varies from twenty-one to seventeen. This fact alone indicates that it is extremely variable. Ruthven ('08) records cases where certain species of *Thamnophis* gave birth to young bearing the characteristic marks of other species. Many specimens of *Thamnophis* have been differently classified by different authorities. The facts set forth in this paper show that there is great variation in different individuals. In consideration of the above facts it seems likely that the *individual variability* of *Thamnophis* has been too largely taken to represent *specific variability*. The writer desires to express his admiration for the excellent efforts of Ruthven ('08) to synthesize this genus.

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STUDIES OF MYXOSPORIDIA FROM THE URINARY BLADDERS OF WISCONSIN FISHES

By J. W. Mavor and W. Strasser.

1. Introduction.

Considerable interest is attached to the geographical distribution of protozoan parasites and their occurrence in different species of hosts. The present paper gives the results of examinations of the urinary bladders of some of the commoner species of fishes occurring in the lakes surrounding Madison, Wisconsin. In all, five species of fish have been examined and four species of myxosporidia have been found. One of these, *Myxidium lieberkuhni*, occurs in the pike, *Lucius lucius* in both Europe and America. The other three are described as new species. The attempt has been made to find characters which distinguish the plasmodial stages of the different species.

2. Methods.

The work of examining the urinary bladders has been much facilitated by the employment of a method which does not involve the killing of the fish. A fine glass canula, provided with a rubber tube to which suction could be applied by the operator, was inserted into the bladder of the fish through the urinogenital opening. In this way a small quantity of the urine with the contained myxosporidia could be drawn into the canula, and by working the canula against the walls of the bladder attached forms could also be obtained. It was found that the urine could be kept in the canula for one or two hours without injury to the plasmodia. Fresh preparations were made from the urine. The "hanging drop" method was found to be the best; a small quantity of urine was spread on the center of a coverglass which was

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then inverted over a hollow slide at the same time being sealed with vaseline. Such preparations preserve the natural form of the plasmodia and are free from the movements which result from using an oil immersion objective on an ordinary fresh preparation. For the study of the preparations an apochromatic immersion objective was used; it being found impossible to determine the colors of the small granules of the plasmodia with an acromatic objective. The greater part of our work has been done on fresh preparations, as the study of these is believed to give the most reliable characters for systematic determinations. All measurements given were made on fresh preparations, the outlines being drawn with the camera lucida and measured with a stage micrometer.

3. Diagnosis of Species.

a. Henneguya wisconsinensis. ***Mavor and Strasser.***

This species has been discussed by us in a previous paper (1916) and was there recorded from the yellow perch, *Perca flavescens* Mitchill. We now record its occurrence in the sunfish, *Lepomis pallidus,* Mitchill, the large mouthed black bass, *Micropterus salmoides* Lacepede, and the speckled trout, *Salvelinus fontinalis,* Mitchill. As there are considerable differences in the parasites found in these four fish, we are doubtful whether they ought not to be assigned to different species, but content ourselves with recording the differences we have found.

We quote our original description of *Henneguya wisconsinensis:*—"The Myxosporidium (plasmodium) is usually elongated and has the general form of a limax amoeba, and may reach a size of 300 x 70μ Ectoplasm and endoplasm are clearly to be distinguished. The pseudopodia are lobose." To this we have to add the following: In *Lepomis pallidus* the pseudopdia may be very thin and many times as long as the body of the plasmodium. In *Micropterus salmoides* fine radiating pseudopodia are found extending from all parts of the body giving some of of the plasmodia the general appearance of a heliozoan, while in others the pseudopodia are short, fine and bunched together, giving the part of the plasmodium from which they arise a villate appearance. The latter pseudopodia undoubtedly function in attaching the plasmodium to the wall of the bladder. In *Salvelinus fontinalis* the plasmodium shows only lobose pseudo-

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podia, and contains rather fewer granules, being more transparent.

"The pansporoblast contains two sporoblasts." This we have found to be the case in the parasite of each of the four species of fish, but in the *Lepomis pallidus* the spores may develop singly, one in a plasmodium.

"The spores are ovoid bilaterally symmetrical, and have a bifurcated caudal filament extending from the posterior end. The two polar capsules are situated near together in the broader, anterior end."

We have found that there is a considerable difference in the dimensions of the spores in the different hosts. The following table shows the results of measurements:

SPORE MEASUREMENTS IN μ

	Perca flavescens	*Lepomis pallidus*	*Micropterus salmoides*	*Salvelinus fontinalis*
Length (to end of spore cavity)..	11.	13.0	13.0	13.
Tail	10.	18–28	18.	30.
Total length	21.	32–42	41.	44.
Width	7.	7.	7.5	6.
Length of polar capsules	3.5	3.5	3.	4.
Width of polar capsules	2.5	2.5	2.	2.5
Length of polar filaments	30–40			

The spore envelope is marked by longitudinal ridges extending from end to end of the body of the spore, a feature which was omitted in our first description.

b. Henneguya *sp.*

We have been able to identify only the spores of this species, which is found in the urinary bladder of *Lepomis pallidus* simultaneously with *H. wisconsinensis*. The spores are very like those of *H. wisconsinensis*, but differ in the size of the polar capsules and the length of the caudal filaments. The dimensions of a typical spore are as follows:

Length (to end of spore cavity)	14–16μ
Tail	6– 8μ
Total Length	20–24μ
Width	6.5– 7μ
Length of polar capsule	8– 9μ
Width of do. do.	2.5– 3μ

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The capsules contain about ten coils of filament.

c. Myxidium lieberkuhni *Butschli.*

A full description of this species as found on the American continent has been given by the senior author Mavor (1916). A complete list of references is given in Auerbach (1910). The dimensions of a typical spore are here given for comparison with the species to follow.

Length	18–19μ
Width	5– 6μ
Length of polar capsules	5μ
Width do. do.	2.5–3.0μ
Length of do. do.	40–45μ

d. Myxidium salvelini *n. sp.*

The plasmodium is large measuring as much as 75μ. The pseudopodia are lobose.

The pansporoblasts, of which there may be many in a single plasmodium, contain two sporoblasts which each develop into one spore.

The spores are spindle shaped with a polar capsule at each end. Each capsule contains about three coils of a rather thick filament. The dimensions of a typical spore are:

Length	11μ
Width	4μ
Length of polar capsule	3μ
Width of do. do.	2.5μ

The parasite occurs in the urinary bladder of *Salvelinus fontinalis* simultaneously with *Henneguya wisconsinensis.*

LIST OF HOSTS OF MYXOSPORIDIA IN THE URINARY BLADDER

HOSTS	MYXOSPORIDIA.
	Henneguya wisconsinensis
Lepomis pallidus Mitchill	Mavor and Strasser.
do.	*Henneguya sp.*
Lucius lucius L.	*Myxidium lieberkuhni* Butschli
Micropterus salmoides Lacepede	*Henneguya wisconsinensis* Mavor and Strasser.
Perca flavescens Mitchill	do. do.
Salvelinus fontinalis Mitchill	do. do.
do.	*Myxidium salvelini* n. sp.

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PAPERS CITED

Auerbach, M.—1910. Die Cnidosporidien, Leipzig.

Mavor, J. W.—1916. On the occurrence of a parasite of the pike in Europe, Myxidium lieberkühni Bütschli, in the pike on the American continent and its significance.

Mavor, J. W. and William Strasser.—1916. On a new myxosporidian, *Henneguya wisconsinensis* n. sp., from the urinary bladder of the yellow perch, *Perca flavescens*.

DESCRIPTION OF PLATES.

All drawings were made with the camera lucida from fresh preparations of the urine.

PLATE I.

Fig. 1. *Henneguya wisconsinensis* from *Micropterus salmoides*.. Plasmodium. No differentiation into ectoderm and endoderm visible. ×970.

Fig. 2. *Henneguya wisconsinensis* or *Myxidium salvelini* from *Salvelinus fontinalis*. ×2500.

Fig. 3. *Henneguya wisconsinensis* or *H.* sp. from *Lepomis pallidus*. Plasmodium. Ectoplasm and endoplasm are differentiated and there are no larger granules. ×2200.

Fig. 4. *Henneguya wisconsinensis* from *Micropterus salmoides*. Plasmodium. Ectoplasm and endoplasm are differentiated and there are fine pseudopodia for attachment to the bladder wall. ×970.

Fig. 5. *Myxidium salvelini* from *Salvelinus fontinalis*. Plasmodium. There is no differentiation into Ectoplasm and endoplasm. The pansporoblasts are in various stages of development into sporoblasts and spores. ×970.

PLATE II.

Fig. 6. *Henneguya wisconsinensis* from *Lepomis pallidus*. Plasmodium. The protoplasm is divided into ectoplasm and endoplasm. The endoplasm is finely granular and contains larger greenish granules of varying size. The plasmodium contained a single spore. ×1250.

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Fig. 7. *Henneguya* sp. from *Lepomis pallidus.* Plasmodium. ×1250.

Fig. 8. *Henneguya* sp. from *Lepomis pallidus.* Plasmodium with long fine pseudopodia. ×1250.

Fig. 9–10. *Henneguya wisconsinensis* from *Lepomis pallidus.* Developing spores showing how the tail is wound round the spore during development. ×4100.

PLATE III.

Fig. 11. *Henneguya wisconsinensis* from *Micropterus salmoides.* Spore showing the polar capsules, curved caudal filaments, nuclei of capsueogenous cells near the respective capsules, valve cell nuclei near the caudal filaments and a single nucleus in the sporoplasm. The longitudinal lines represent the ridges on the spore envelope. ×4100.

Fig. 12. *Henneguya sp.* from *Lepomis pallidus.* Spore showing polar capsules, filaments, tail and sporoplasm. ×4100.

Fig. 13. *Henneguya wisconsinensis* from *Salvelinus fontinalis.* Three spores in a plasmodium showing the long caudal filaments of each spore bursting through the protoplasm of the plasmodium. ×2500.

Fig. 14. *Henneguya wisconsinensis* from *Lepomis pallidus.* Spore showing caudal filaments still united, the polar capsules containing the coiled polar filaments and the sporoplasm containing two nuclei. ×4100.

Fig. 15. *Myxidium salvelini* from *Salvelinus fontinalis.* Spore showing two polar capsules, one with polar filament partly extended, sporoplasm containing two nuclei. The longitudinal ridges on the spore envelope are shown by lines. ×4100.

Fig. 16. *Henneguya wisconsinensis* from *Lepomis pallidus.* Plasmodium containing a single spore the caudal filaments of which are bursting through the protoplasm.

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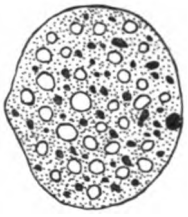

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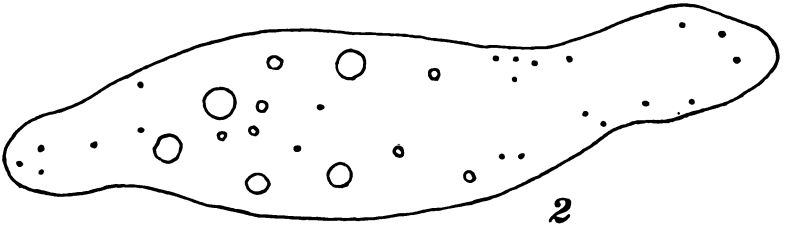

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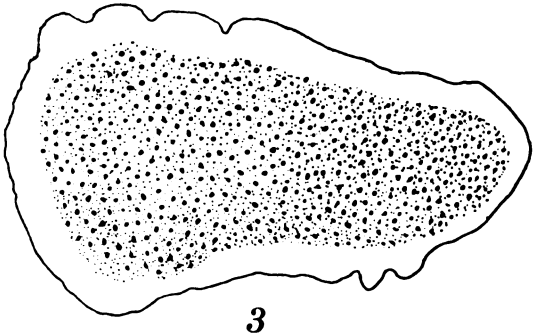

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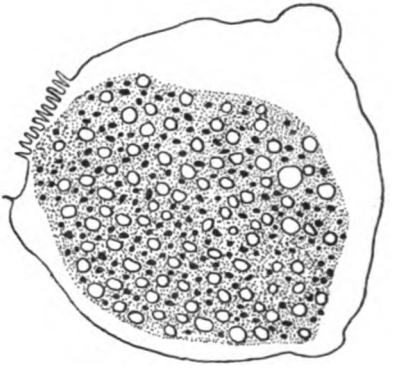

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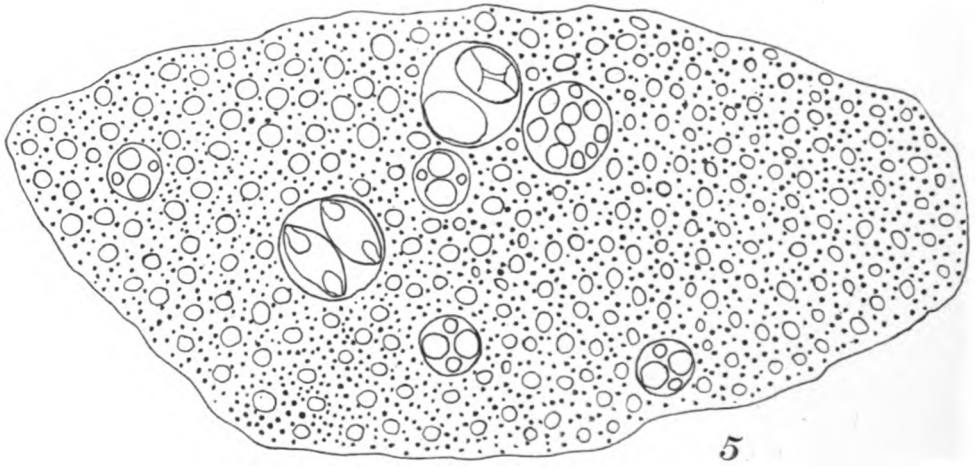

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MAVOR & STRASSER — MYXOSPORIDIA.

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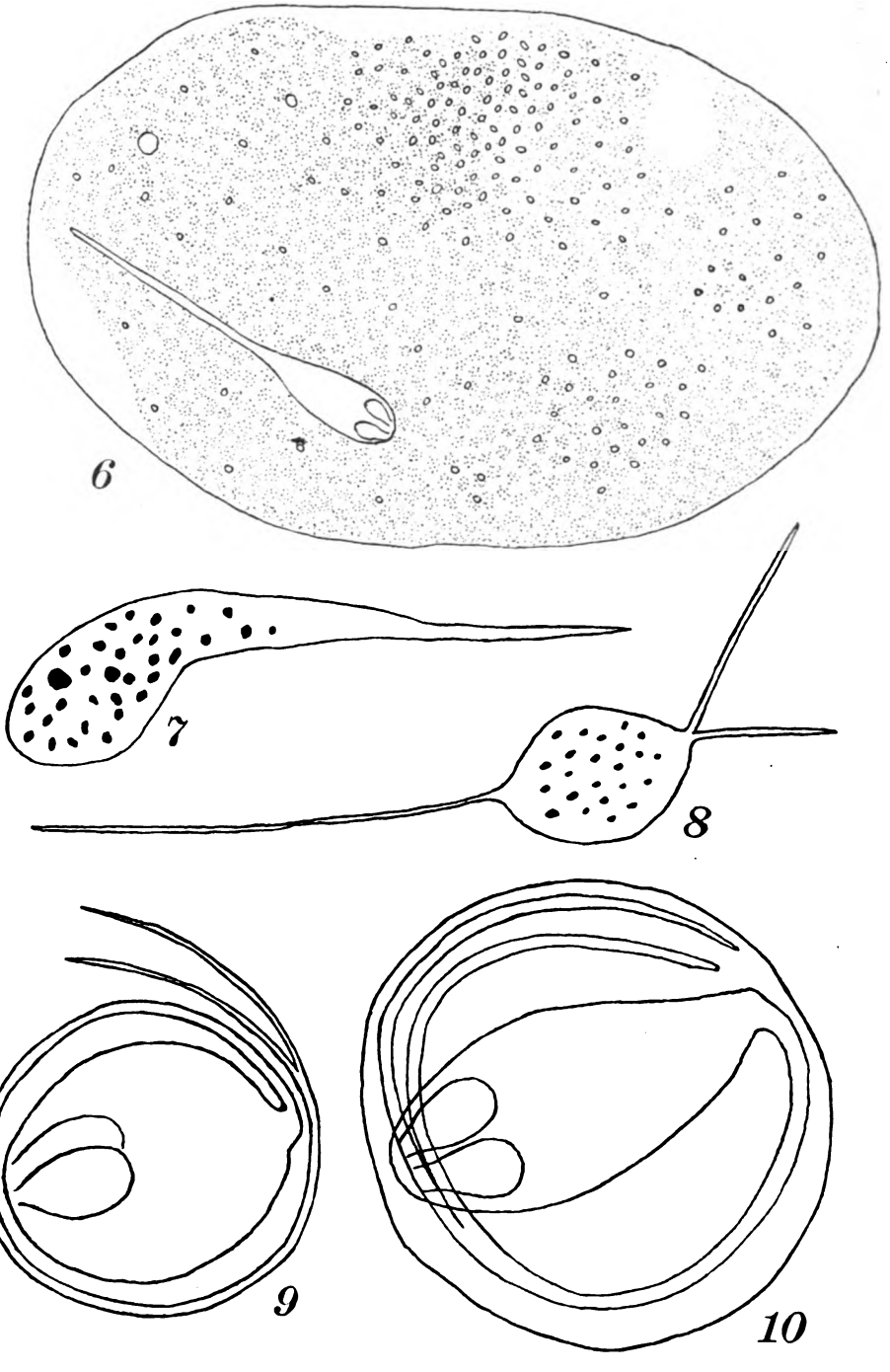

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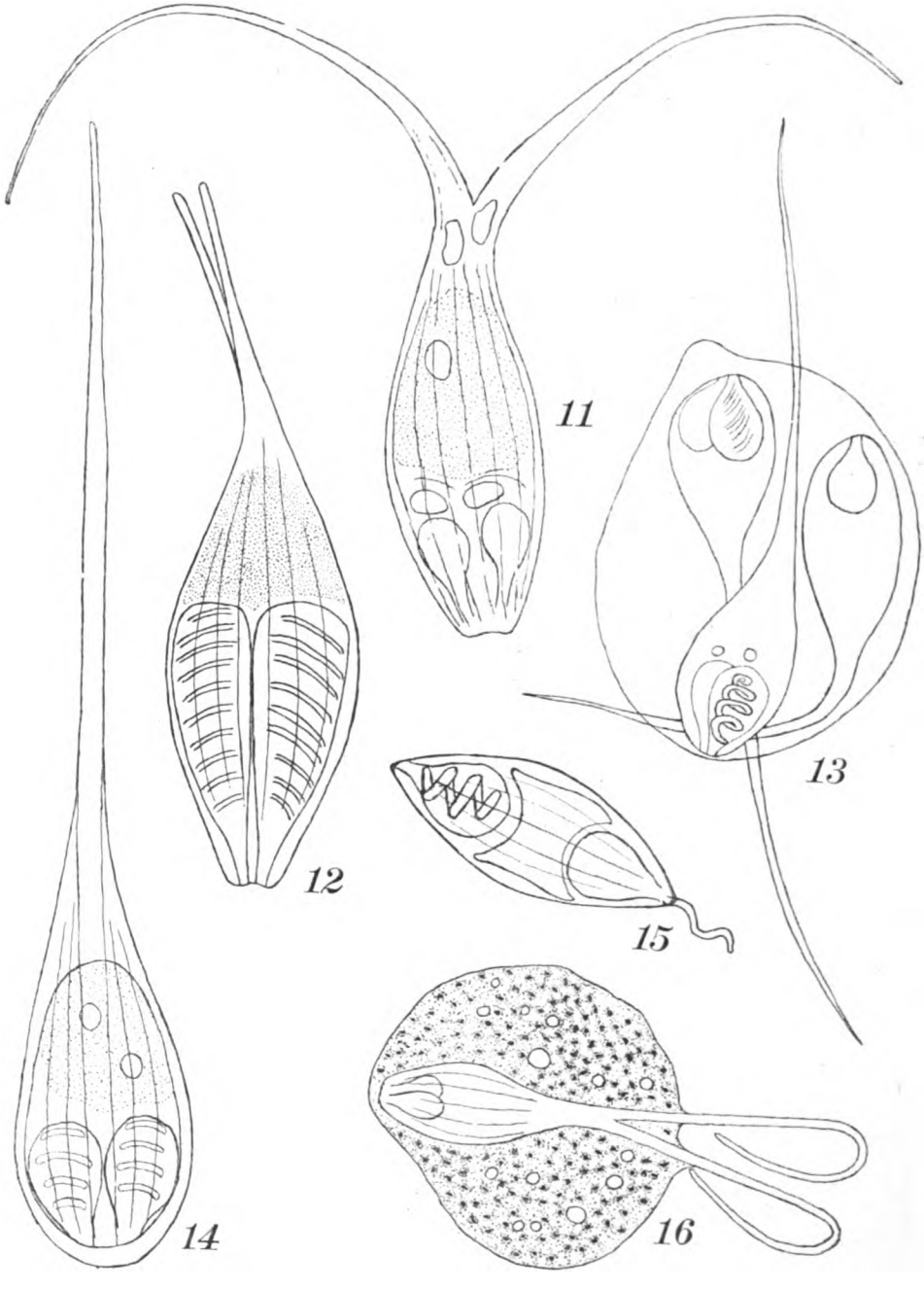

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LYMPHOCYSTIS VITREL

A NEW SPOROZOAN FROM THE PIKE-PERCH, STIZOSTEDION VITREUM, Mitchell

BY

J. W. MAVOR, S. M. FEINBERG.

In the course of investigations on the protozoan parasites of Wisconsin fishes a diseased condition of the skin and underlying tissue of the Wall-eyed Pike or Pike perch, (*Stizostedion vitreum*, Mitchell) came to our notice. The diseased fish were caught by the State Fish Commission at Minocqua, Wisconsin, on April 29th and May 5th, 1915, and sent on ice to Madison for investigation. They were kindly turned over to us by Dean Birge and Professor Wagner of the University of Wisconsin.

The diseased condition was, we understand, prevalent at that time in the Northern part of the state. Owing to the delay involved in the transport and turning over of the fish to us, the fish showed early stages of decay when they came into our hands, a fact which led to the somewhat imperfect preservation of our material.

The observations on the fresh material were made by the senior author at a time when the press of teaching work necessitated their being rather brief. The external evidences of the disease, as seen in the dead fish, were numerous swellings on the surface of the body and on the fins (Plate IV, Fig. 1). The surfaces of the swellings showed small round light colored elevations which on dissection were found to contain white spherical bodies from .5 to 1 mm. in diameter.

A microscopic examination of these cysts in the fresh state showed them to consist of a resistant transparent envelope filled with a granular mass surrounding a clear well defined central

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area. The study of the fresh material was not carried further and the internal organs, already in a state of decomposition, were not examined.

Portions of the diseased tissue were fixed in Schaudinn's alcohol-sublimate mixture and in Fleming's stronger fluid. The sections were cut in paraffin 5 to 10μ in thickness and stained with Heidenhain's iron haematoxylin and Delafield's haematoxylin. The cyst envelope already mentioned in the description of the fresh material stains deeply with the haematoxylin (Plate IV. Fig. 2). Two kinds of cysts can be distinguished in the preparations. Firstly, there are cysts containing a single large nucleus. The cytoplasm of these cysts shows a coarse net-work containing faintly staining granules. There also occur in the cytoplasm deeply staining chromidial masses (Plate IV, Fig. 2). These chromidial masses resemble both in their occurrence and structure very closely the masses described by Awerinzew (:09 p. 343) in *Lymphocystis johnstonei*. In each of the cysts containing chromidial masses there is a single large nucleus irregularly spherical in shape and of a diameter approximately one third that of the cyst. We are unable to decide whether the irregular form of the nucleus is natural or due to poor fixation but are inclined to the latter view since in the preparations also the cyst envelopes, which in the fresh state are regularlly spherical, appear irregular and shrunken. Secondly, there are cysts containing amoebulae. In these cysts no large nucleus is found. The cytoplasm stains more deeply and the chromidial network described above seems to have completely filled the cyst. Distributed in this network are to be found unstained areas containing a faint and fine meshwork in the centre of which is a deeply staining body. These are undoubtedly to be recognized as the amoebulae of Awerinzew (:09, p. 356). The central body is the nucleus.

The close resemblance between the parasite described and *Lymphocystis johnstonei* Woodcock as described by Awerinzew (:09) would seem sufficient reason for assigning it to the genus *Lymphocystis*.

Although the genus *Lymphocystis* is certainly to be included in the Sporozoa its more precise systematic position is a doubtful question toward the solution of which we are unable to contribute.

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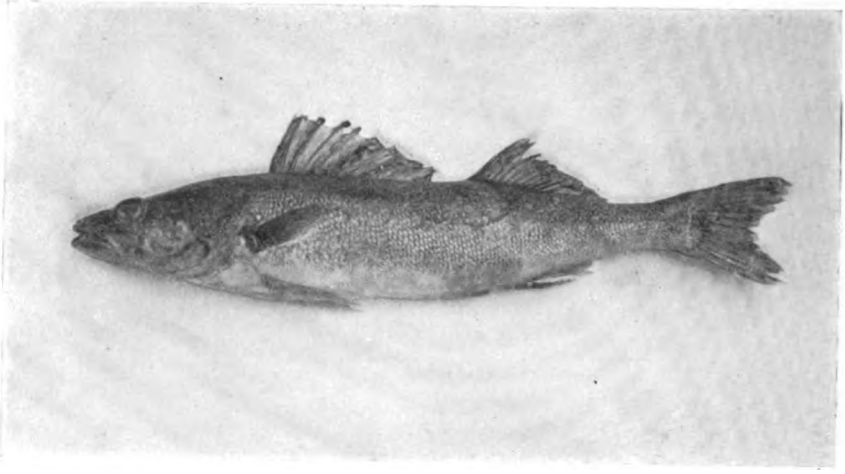

FIG 1

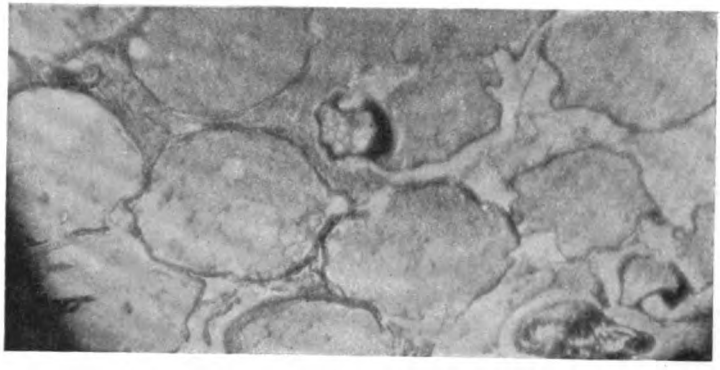

FIG. 2

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PAPER CITED.

Awerinzew, S.—1909. Studien uber parasitische Protozoen. II Lymphocystis johnstonei Woodc. und ihr Kernapparat. Arch. f. Protest. Bd. 14; p. 335.

DESCRIPTION OF PLATE IV.

We are indebted to Mr. Cahn of the Department of Zoology, Wisconsin University, for taking these two photographs.

Fig. 1. Photograph of a diseased walleye.

Fig. 2. Photomicrograph of sections stained with Heidenhaim's iron haematoxylin, showing a number of cysts closely packed together.

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SELECTIVE ABSORPTION IN THE VISIBLE SPECTRUM OF WISCONSIN LAKE WATERS

W. B. PIETENPOL

Notes from the Laboratory of the Wisconsin Geological and Natural History Survey. XII.

1. INTRODUCTION

When light is transmitted through a material medium some of the radiant energy is absorbed, that is, transformed into another form of energy, as heat, chemical energy, or some other frequency of radiation. All bodies, even the most transparent for visible light as water, glass, quartz, etc., possess this property of absorption. A body is colorless by transmission when it transmits the same percentage of radiation for every wave-length or frequency. On the other hand a body may show selective absorption and the color of the body is determined by the wave-length of that radiation of which the greatest percentage is transmitted. A determination of the selective absorption in the visible spectrum of distilled water and the waters of some Wisconsin lakes, giving the relation between the decrease of intensity and depth of penetration as a function of wave-length, was the object of this investigation.

In connection with the work on limnology, carried on by Dr. E. A. Birge and Mr. C. Juday of the Wisconsin Geological Survey, it was of interest to ascertain the rate of absorption of light energy by lake waters. This has a direct influence upon the temperature of the water and also upon the chemical action which takes place beneath the surface of the lake. Recent experiments with color filters have shown that the physico-chemical changes in plant life which result from light

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action, depend up the quality as well as the intensity of the light incident upon the percipient region. Electrons affected differently by the action of light of one wave-length and another are the cause of the chemical actions from which results the building up of complex organic molecules. The chlorophyl of the plant has been found to be more sensitive to the blue, or light of short wave-length than to that of long wave-length. So the absorption spectra of the different lake waters should have a direct bearing upon the nature of the planktonic life found in these lakes. With such an incentive work was begun in the Physical Laboratory of the University of Wisconsin during the summer of 1914 and continued during the two years following. The results of this investigation we hope may be of value to the limnologist.

2. General Statement

Since 1882, the selective absorption theory has been quite generally recognized as explaining the color of water. In opposition to this, the theory of selective reflection had attributed the color to light reflected from extremely small particles held in suspension. The effect of such small particles in scattering incident radiation has been fully discussed by Lord Rayleigh, who based upon this his mathematical theory of the blue color of the sky. When the particles of matter are large compared with molecular dimensions the luminosity is reduced fairly equally throughout the range of the visible spectrum, and there would be no great change in the relative intensities of red and blue. When, however, the particles are of molecular dimensions the scattering in the extreme violet is sixteen times as great as in the extreme visible red. An approximation of Rayleigh's formula shows that the intensity of the scattered light varies inversely as the fourth power of the wave-length. The general theory of radiation scattered by a spherical obstacle has led to an extensive study of colors exhibited by colloidal solutions, metal glasses, and metallic films. Mie[1] in his electromagnetic consideration of scattered radiation shows curves for absorption in colloidal gold solutions and it may be of interest to note that for particles of size $160\mu\mu$ the curve shows a resemblance to the absorption curve of distilled water.

[1] Mie. Ann. der Phys. Vol. 25, p. 377, 1908.

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The total amount of energy which a particle absorbs from the incident radiation consists of two parts, that which is scattered, and that which flows into the particle and is transformed into heat or chemical energy. On the selective absorption theory of the color of water, however, it is necessary to differentiate between what is true absorption and simply obstruction. The work of Aitken[1] and others[2] has shown that the color is not of the nature of that due to the scattering by small bodies but is a phenomenon primarily dependent on the water itself. While the object of this investigation was not primarily that of making a check on the selective absorption theory, satisfactory experimental evidence will be given later in this paper to show that it is the correct one.

For a long time it has been a matter of conjecture as to what is the true nature of absorption in an aqueous solution. Its characteristic color was at one time thought to be due to resonating chemical molecules which responded to light of a certain frequency and as a result the color of the corresponding wave-length was absorbed. With the introduction of the theory of electrolytic dissociation in 1886 the ion as well as the molecule was found to play an important rôle. The determination of the relation between selective absorption and dissociation was the purpose of an extensive work carried on by Ostwald[3] in 1892. It was known, however, that absorption was not entirely due to the ions present since non-electrolytes as well show selective absorption. Jones and Anderson[4] came to the conclusion that the difference between the absorption of molecules and ions must be slight. They showed that the solvent affects to a marked degree the power of the solute to absorb light. In a later work Jones and Strong found this to be true for a number of substances. It was attributed to the combination of the dissolved substance with the liquid and seemed satisfactorily explained by the solvate theory of solution[5] This theory was also used to explain the results of Jones[6] and Guy,[7] which are of great importance in their bearing upon

[1] "On the Colour of the Mediterranean and other Waters." Proc. Roy. Soc. Edinbg. Vol. 11, p. 472. 1882.
[2] Nature, Vol. 59, p. 461, 1899.
[3] Zeit. phys. Chem., Vol. 9, p. 579, 1892.
[4] Carn. Inst. Wash. Pub. 110. 1909.
Amer. Chem. Journ., Vol. 37, p. 126, 207, 1907.
[5] Carn. Inst. Wash. Pub. 130 and 160. 1911.
[6] Jones. Amer. Chem. Journ., Vol. 23, p. 89, 1900.
[7] Guy Carn. Inst. Wash. Pub. 190. 1913.

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the selective absorption of water. They studied the relation between molecular absorption and the absorption by ions which are formed when these molecules dissociate. A concentrated solution of a salt contains very many molecules in comparison to the number of ions. Dissociation takes place with dilution and the number of ions increases at the expense of the number of molecules present. Taking comparison absorption spectra of solutions of different concentration but with the same number of parts of solute present it was found that ions have somewhat different absorbing powers from molecules. The more concentrated the solution the greater is the absorption and the broader and less intense are the absorption bands, which are also displaced towards the shorter wave-lengths. An interesting result of this work is the effect of the dissolved substance on the spectra of water. Certain aqueous solutions of hydrated salts are more transparent than pure water, the combined water having less power to absorb light than free or uncombined water. An aqueous solution of a non-hydrated salt, provided the salt itself does not absorb light, has nearly the same absorption as does pure water having the same depth as the water in the solution. For a strongly hydrated salt the absorption is in general much less than the corresponding layer of water.[1]

Selective absorption is without question an electronic resonance phenomenon. Electrons having definite periods of vibration give the media the power to absorb radiations, the frequencies of which agree with those of the electrons. The period depends upon the chemical constitution or the arrangement of the atoms in the medium. Atoms existing as elements or in certain compounds may show an absorption very different than when in complicated organic compounds, as in the case of the aniline dyes where the selective absorption is very great. The part the electron plays seems important as shown in the effect of dilution upon absorption.

3. Apparatus and Methods

The method employed was an optical one, the relative intensities of two spectra at specific wave-lengths giving a measure of the absorption of the water. The spectrophotometer used

[1] E. J. Schaeffer, M. G. Paulus; H. C. Jones. Phys. Zeitsch., Vol. 15, pp. 447–453, 1914.

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was an instrument of the König-Martins[1] type. It involves the use of polarized light and the equalization in intensity of the two rays by means of a rotating Nicol prism. The two beams which are to be compared are focused on lateral halves, S_1 and S_2 (Fig. 1) of a divided slit. After passing through

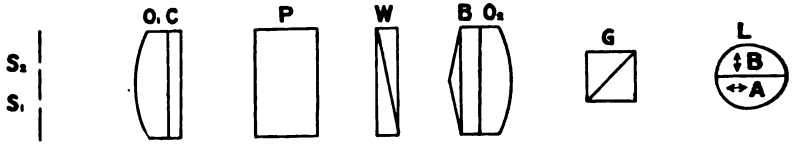

Fig. 1. Arrangement of optical parts of spectrophotometer.

the collimation lens O, and also the crown glass prism, C, for deviating reflected light, they are dispersed by the prism P. The light is then polarized by the Wollaston double image prism W and displaced by the biprism B so that of the eight spectra produced but two are used. These two are polarized in perpendicular planes. The eye-piece contains a Glam-Thompson prism, G, which acts as an analyser resolving all plane polarized light reaching it into two components vibrating perpendicular to each other and transmitting only that component vibrating parallel to the section. The circular field of view, L, is seen in the eye-piece divided into two halves. One half is illuminated with light from slit S_1 vibrating in a vertical plane and the other half with light from slit S_2 vibrating horizontally. By rotating the Nicol the brightness of the two fields, which are illuminated by a narrow portion of the visible spectrum, can be equalized and from the angle of rotation the relative intensities of the original rays can be calculated. If the amplitudes of the linear light vibrations in the fields, A, and B, (Fig. 1) are represented by OA and OB, (Fig. 2) and ON is the plane of transmission of the analyser, then OA′ and OB′ will represent the amplitude of the light transmitted through A and B. So for equal intensity of A and B,

$$OA \cos \theta = OB \sin \theta$$

$$\text{or, } \frac{OA}{OB} = \tan \theta$$

[1] Ann. der Phys., Vol. 12, p. 984, 1903.

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and since the intensity is proportional to the square of the amplitude,

$$\frac{J_a}{J_b} = \tan^2 \theta.$$

The angle θ is obtained from the reading of the circular scale of the analyser, when the reference point $J_b = 0$ has previously been determined.

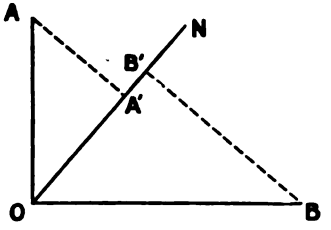

Fig. 2. See explanation in text.

If the intensity of a comparison ray is measured against that of a ray which passes through an absorbing medium the following relation exists,

$$\frac{J_o}{J_1} = \tan^2 \theta_1$$

In comparison now with the ray when it has passed through a different thickness of the absorbing material,

$$\frac{J_o}{J_2} = \tan^2 \theta_2$$

and,

$$\frac{J_2}{J_1} = \frac{\tan^2 \theta_1}{\tan^2 \theta_2}$$

The coefficient of absorption, A, is defined by the equation.

$$J' = J\, e^{-Ad}$$

where J is the intensity of the oncoming light, J′ is the resulting intensity, and d is the thickness of the absorbing medium. As a result there exists the relation,

$$e^{-Ad} = \frac{\tan^2 \theta_1}{\tan^2 \theta_2}$$

and,

$$A = \frac{1}{d} \log \frac{\tan^2 \theta_2}{\tan^2 \theta_1}$$

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Determining the values of θ_1 and θ_2 by the comparison method, the coefficient of absorption per meter length was found for certain wave-lengths by use of this equation.

With this form of spectrophotometer settings can be made to a high degree of accuracy, so that with good illumination check settings can be made to within the limits of error of the scale reading itself. Under the working conditions which were found to be necessary, however, such accuracy was not obtainable. The intensity of the source for different wave-lengths varies greatly and it falls off rapidly toward the blue end of the spectrum. The retina of the eye reacts to light in a way that is also a function of wave-length. The rate at which the visual impression develops varies with both the intensity and the wave-length of the light that produces it as well as with the previous treatment of the retina. This was considered in the number of readings necessary so that for a single determination of the angle of the analyser the average of a number of settings varying from five to fifteen and in extreme cases even twenty or more were taken depending upon the reading of the wave-length scale. In order to eliminate any personal equation every one of the twenty-eight thousand spectrophotometer settings necessary to complete this investigation was made by the writer.

Since the wave-length scale of the spectrophotometer is entirely arbitrary, a calibration was made from certain standard wave-lengths. For this purpose were used the sodium, the lithium, and the argon lines, the violet, green, and yellow mercury lines, and the blue, green, yellow, and red helium lines. To correct for a noticeable width of the lines as seen in the instrument, an average of the readings of both edges of the line was taken as the position of the line on the scale.

Due to the very small absorption coefficient of distilled water and some of the lake water measured, a long absorbing column is necessary. After careful experimenting, the apparatus was used as shown in Fig. 3. N is a Nernst glower which was run at full intensity and a narrow portion of which was cut out by the slit S so as to make it as nearly as possible a point source. The diverging beam was made parallel by an achromatic lens L_1 of 50 cm. focal length and then divided by the plate glass, P. The transmitted ray entered the brass tube, T, through the opening O, which was one cm. in dia-

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meter. The tube was paraffin lined and had a length of 320 cm. and a diameter of 5 cm. Emerging from the tube containing the absorbing solution, the ray was brought to a fine focus upon the ground glass front plate, G, of the spectrophotometer by the combination of achromatic lenses L_2. This image was used as the effective slit-width and sent into the slit of the photometer, S_1. The comparison ray reflected from the plate glass P passed successively through the total reflecting prisms, R_1 and R_2. It was then brought to a focus in about 11 cm. by the combination of achromatic lenses, L_3. By means of the total reflecting prism R_3 it was sent into the slit, S_2, with the same convergence as the direct ray which enters S_1.

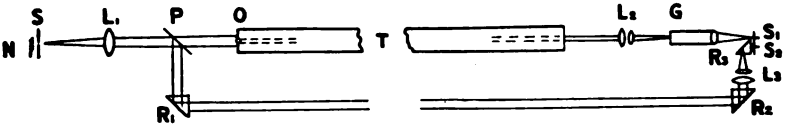

Fig. 3. Arrangement of apparatus for observations on water.

For the determination of the absorption coefficient two runs are necessary, one when the comparison ray is set against the ray which passes through the tube, T, of very short length and the other when the tube is of full length. By this means the difference between the reflection of glass-water and glass-air surfaces, which would exist if readings were taken with the tube empty and then filled with water, are eliminated. A difficulty which was encountered in first testing out the apparatus was the inability to make a satisfactory check for the coefficient of absorption of water when different lengths of tubing were used. With a wide beam of parallel light almost equal to the inner diameter of the tube, focussed upon the slit of the spectrophotometer there was apparently a drop in the violet portion of the absorption curve with increased length of water column. This seemed satisfactorily explained by the non-achromatism of the lenses first used in addition to the effect the column of water might have, since the violet rays are more refrangible than the red. It may possibly explain the low values found by von Aufsess ('03, p. 26. See also table 1 of this paper.) in the short wave-length region of the spectrum.

When the glass end plates of the tube were not accurately parallel, the column of water acted as a prism of small angle

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and a distortion of the image with change of color resulted. By putting set-screws on the tube, the plates were made adjustable and set accurately parallel by an optical method.

4. Readings on Distilled Water

The readings first taken were upon distilled water so that a comparison could be made with the results of previous investigators. Distilled water was used throughout the preliminary work of refining the apparatus and the coefficients given in Table 1 indicate the final results obtained. The results of Hüfner and Albrecht,[1] Ewan,[2] Aschkinass,[3] and von Aufsess[4] are also recorded. The values are given for the absorption-coefficient, A, as defined by the equation

$$J' = Je^{-Ad}$$

where $d = 1$ m.

In all of the tables and diagrams the absorption of light is stated in terms of the coefficient of absorption per meter. This is the reciprocal value of the thickness of the stratum of water which would reduce the intensity of the transmitted light to the fraction $\frac{1}{2.7183}$ of its value at entrance. The number 2.7183 is the basis of the natural system of logarithms and the value of the fraction is approximately 0.37. This coefficient may be stated in terms of any desired unit of measure for the thickness of the stratum. In this case the meter is employed. An absorption coefficient of unity, therefore means that a stratum of water whose thickness is unity (1.000 meter) absorbs so much light that the intensity of the transmitted light is equal to 0.37 of its original value. An absorption coefficient of .200 means that if the ray of light were passed through a layer of water 5 meters thick ($\frac{1.000}{.200}$) its intensity would be reduced to 0.37 of its original value. Similarly a coefficient of 1.250 would mean that 0.80 meters would reduce the intensity of transmitted light to 0.37 of its original value.

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[1] Hüfner and Albrecht, Wied. Ann. d. Phys. u. Chemie, Vol. 42, pp. 1–17, 1891.

[2] Ewan, Proc. R. Soc. 57, p. 117–161, 1894.

[3] Aschkinass, Wied. Ann. d. Physik. und Chemie, Vol. 55, p. 401, 1895.

[4] Aufsess. Die Farbe der Seen, Inaug-Diss. München, 1903.

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For the purposes of this investigation the results might as well have been stated in terms of the percentage of transmission of light by a meter of water as in those of the coefficient of absorption. The method employed is that regularly used by physicists and is of advantage in certain types of computation.

TABLE 1

COEFFICIENT OF ABSORPTION. DISTILLED WATER

Wave length	Hüfner u. Albrecht	Ewan	Aschkinass	Aufsess	Pietenpol
4150		.065			
4300		.023			
4490	.028	.012			
4500			.020		
4680	.027	.012			
4700					.034
4750			.020		
4870	.037	.014			
4940				.002	.030
5000			.020		
5060	.043	.016	.025		
5220				.002	.030
5250			.015		
5270	.045	.019			
5370			.005		
5390					.022
5500			.036		
5510	.075	.023			
5580				.028	.036
5620			.030		
5750			.020		
5760	.114	.039			
5790				.049	.056
5840		.048			
5870			.051		
5895					.096
5900		.070		.089	
6000			.163		
6005					.165
6020	.250	.109		.173	
6070				.200	
6120			.192	.233	
6170				.244	
6180					.206
6220				.239	
6250			.223		
6310	.282	.130			
6360					.225
6370			.229		
6430				.291	
6480					.236
6500			.255		
6580				.320	
6620			.281		
6630					.245
6640	.393	.173			
6750			.329		
6800		.210			
6870			.371		
6900		.251			
7000			.553		

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There are considerable differences between the results reached by these authorities. The observations of Hüfner and Albrecht, Ewan, and Aschkinass were all made between 1891 and 1895 and had the direct purpose of ascertaining the absorption of light by water. The investigation of Aschkinass is the most complete and extensive and his results are probably the most accurate. The work of von Aufsess on distilled water was done in preparation for studies on lake water. It will be noticed that the results of von Aufsess are regularly lower toward the blue and higher toward the red end of the spectrum than those of Aschkinass or Ewan. My own determinations are in quite as close agreement with those of Aschkinass as could be expected from methods so diverse.

Hüfner and Albrecht were the first to obtain results for distilled water. They compared the intensity of the incident with the transmitted light which had passed through a glass tube two meters in length, filled with water. The width of spectrum used was large, covering 100 Angstrom units or more.

Ewan used a method by which two lenses were filled with light from the same slit, illuminated by an incandescent Auer lamp. One beam of light was passed through a glass tube one meter in length, containing the water, and then compared with the other beam as a standard by means of a Lummer and Brodhun prism. The variation of intensity of the standard beam was produced by means of a rotating sector. The water first used was distilled twice so it would be as free as possible from dust. He found afterwards that water filtered through a Chamberland Pasteur candle was even more devoid of dust than that which had been freshly distilled. Measurements on such filtered water however showed no noticeable difference in absorption.

Aschkinass determined the absorption-spectra of water chiefly for the infra-red rays. The instrument used was a bolometer of ordinary construction and the layers of water varied from .001 cm. to 100 cm. in thickness. In the infra-red a fluorite prism was used, while in the visible spectrum a flint glass prism and, due to the small amount of energy, a larger spectroscope and a more delicate bolometer were required. Nothing is said in regard to the purity of the water.

Observations were made by O. von Aufsess with the aid of a Nernst lamp, a König-Martens spectrophotometer, and a

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zinc tube. He used double-distilled water and water from which the dust particles had been precipitated with zinc chloride. Experiments with turbid distilled water and water from some Bavarian lakes show that turbidity changes the intensity of the color but leaves the absorption bands practically unchanged. The addition of dissolved lime salts to distilled water however changes the color into green. He therefore believes the color of water to be due to chemical composition and not to diffraction in the sense of Soret and Rayleigh.

The observations of the writer upon distilled water were made after great care had been taken to obtain water of the highest possible purity. After distillation the water was passed through a Berkefeld filter, which under right conditions takes out all bacteria. Care was taken to use bottles which for a long time had contained distilled water only. In every case the tube was thoroughly rinsed and the run made immediately after filtering. The water was almost optically clear since but a small amount of scattering was noticeable even when observed at a slight angle with the direction of the oncoming ray.

5. Effect of Turbidity

For the determination of the absorption by lake water the question came up whether the previously described laboratory method could be adopted or whether a method of observing water in its natural state would be necessary. An accurate determination of the selective absorption by lake water in the unfiltered state offered almost insurmountable difficulties, due to the high turbidity. It was accordingly necessary first to determine whether or not the particles in suspension absorbed selectively. If not, the object sought could be accomplished by bringing in water, filtering, and taking observations in the laboratory according to the method used for distilled water. Preliminary observations on Mendota lake water when different methods of filtering were used, indicated that the absorption by particles was not noticeably selective. Results, taken somewhat later, of the absorption coefficients of water from lakes Mendota and Waubesa under different conditions are given in Table 2. The filtered water was entirely free from particles in suspension, having been forced through a Berkefeld filter. The "effluent" was water which had been

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put through a centrifugal machine and filter papers and the unfiltered lake water was just as brought into the laboratory. It had been strained through a silk net of No. 20 bolting cloth, which removed the crustacea, larger algae, etc., but left the nannoplankton in the water. The corresponding slopes of the curves as shown in fig. 4 indicate most conclusively that the absorption by particles is nonselective in nature. Similar absorption curves for the filtered water and effluent of lake Waubesa are shown in fig. 5.

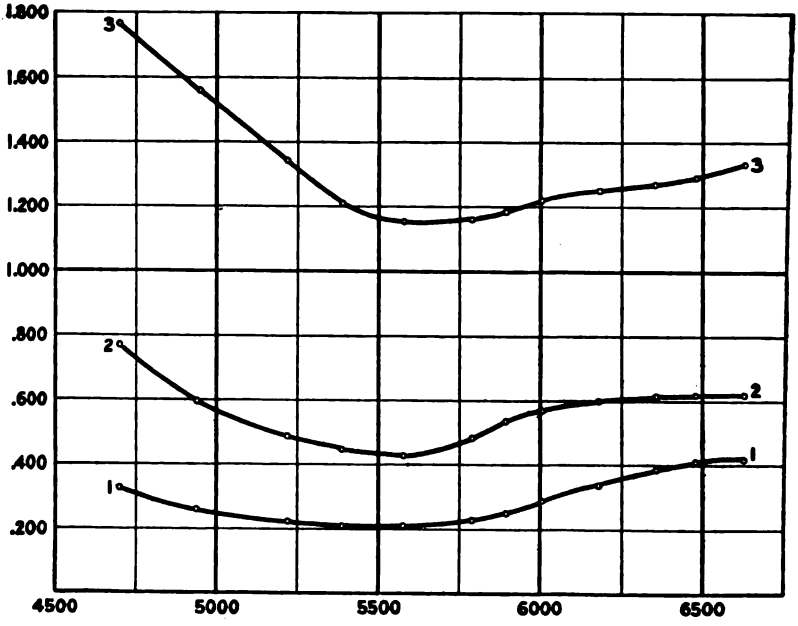

Fig. 4. Absorption curves for water from Lake Mendota, Aug. 16, 1915. 1. Water filtered through Berkefeld filter; 2. "Effluent," i. e. water passed through a De Laval centrifuge and filter, which extracts most of the suspended matter by centrifugal force and by filter papers; 3. Lake water strained through silk bolting cloth and containing all of the nannoplankton.

In this and following figures the wave lengths are platted on the horizontal scale, and the coefficient of absorption on the vertical scale.

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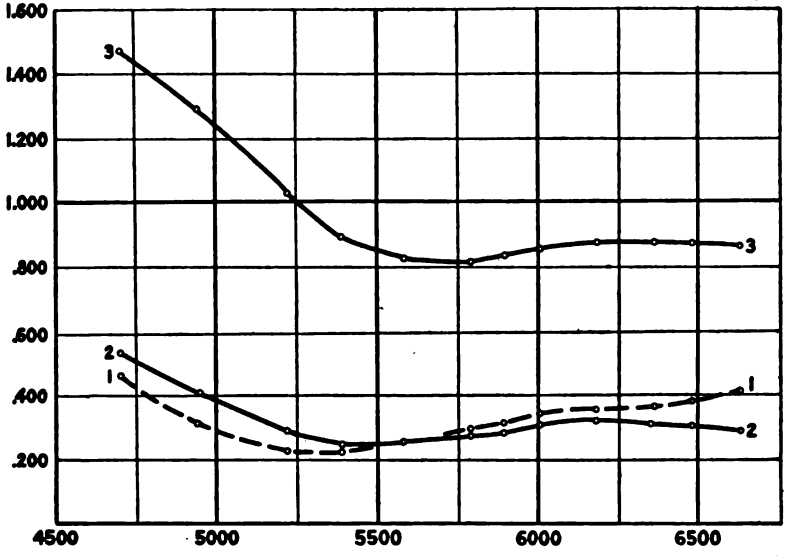

Fig. 5. Absorption curves for water from lake Waubesa, Aug. 11, 1915. 1 and 2, filtered waters; 3, effluent.

TABLE 2

EFFECT OF TURBIDITY ON COEFFICIENT OF ABSORPTION

Wave length	Mendota			Waubesa	
	Filtered	Effluent	Unfiltered	Filtered	Effluent
4700	.321	.718	1.761	.530	1.475
4940	.259	.590	1.560	.408	1.290
5220	.222	.485	1.340	.290	1.030
5390	.209	.444	1.206	.242	.891
5580	.210	.425	1.156	.255	.828
5790	.230	.481	1.160	.276	.815
5895	.249	.531	1.192	.281	.838
6005	.292	.563	1.220	.309	.858
6180	.331	.596	1.250	.320	.878
6360	.381	.614	1.270	.311	.878
6480	.410	.614	1.290	.306	.873
6630	.418	.614	1.334	.297	.863

6. Effect of Time on Color of Water

During the course of this investigation observations were made to ascertain the effect of time upon a highly colored water. On Sept. 3, 1915, three samples of water from Turtle lake were brought to the laboratory and left standing in a dark place for different periods of time. The water was filtered in each case just before the selective absorption was

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determined. The results are given in Table 3. The curves in Fig. 6 show graphically the relation between the color absorption after different periods of time have elapsed. In the curve taken Dec. 4, 1915 a drop in the yellow region of the spectrum indicates the slight loss of color of a dark brown water with time.

TABLE 3

EFFECT OF TIME ON COEFFICIENT OF ABSORPTION

Turtle Lake Water, Samples Taken Sept. 3, 1915

Wave length	Sept. 17, '15	Oct. 18, '15	Dec. 4, '15
5220	1.900	1.770	1.644
5390	1.580	1.420	1.272
5580	1.300	1.210	.995
5790	1.070	1.043	.865
5895	1.015	.990	.886
6005	.958	.947	.832
6180	.925	.890	.804
6360	.879	.827	.765
6480	.859	.806	.733
6630	.828	.777	.730

7. Effect of Depth on Color

Observations to determine the effect of depth upon the color of water were also made. It was noticed, in the case of lake Mendota, that water taken from a considerable depth sometimes appeared to be slightly more highly colored than the surface water. On July 15, 1915 a determination of the selective absorption of Mendota water taken from the surface and from a depth of twenty meters was made. The results for this instance as given in Table 4 show that the absorption by the surface water was greater than that by the deep water throughout the yellow portion of the spectrum, while in the red the reverse relaxation existed. It is possible that greater differences might have been found had water been taken later in the season. In the data which are recorded the wave-lengths are given in Angstrom units.

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TABLE 4
EFFECT OF DEPTH ON COEFFICIENT OF ABSORPTION
Lake Mendota, July 15, 1915

Wave length	Surface	20 meter	Wave length	Surface	20 meter
4700	.259	.274	5895	.239	.254
4940	.186	.172	6005	.243	.278
5220	.146	.154	6180	.294	.321
5390	.141	.167	6360	.356	.364
5580	.153	.173	6480	.374	.369
5790	.199	.217	6580	.376	.372

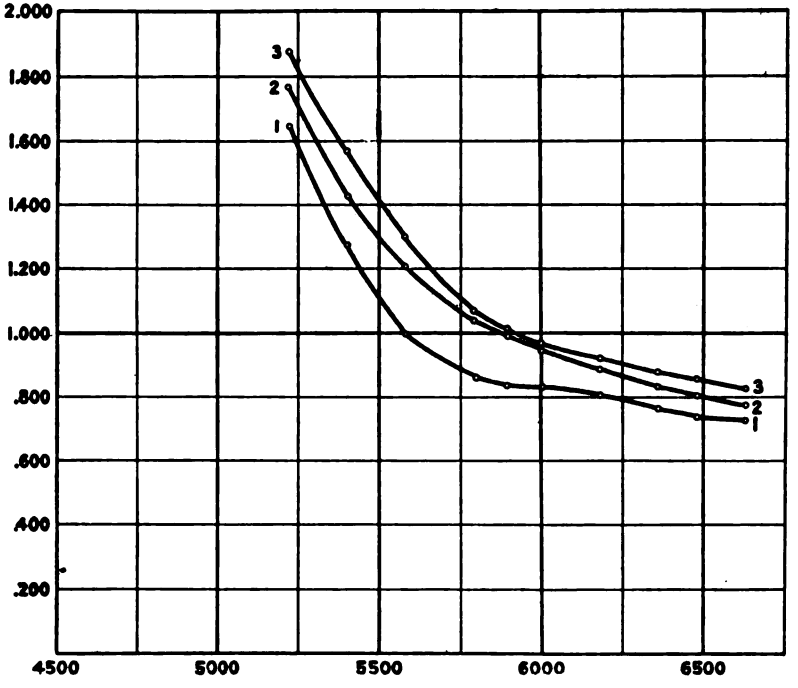

Fig. 6. Absorption curves for water from Turtle lake, to show the effect on time in decolorizing water kept in the dark. 1. Dec. 4, 1915; 2. Oct. 18, 1915; 3. Sept. 17, 1915. Sample was taken Sept. 3, 1915.

8. General Table of Results

The lakes in the following table may be found listed in Juday's report on the Hydrography and Morphometry of Wisconsin lakes (Bull. Wis. Geol. & Nat. Hist. Survey, No. XXVII, 1914.) Table 1, p. 122, and Table 3, p. 125, contain the hydrographic data for all of them.

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The following general facts may be stated:

Eight of the specimens represent lakes or waters from the northeastern part of the state. All are soft water lakes. These are as follows: Allequash, Bass, Bog Hole, Minocqua, Pond No. 1, Swamp Hole, Trout, and Turtle lakes. Lake Superior is in the same general class. Its water was taken from Bayfield harbor and is less clear than water from the open lake.

All the other lakes are in southeastern Wisconsin and belong to several districts and systems. All but Devil's lake have hard water containing much calcium and magnesium carbonate.

Madison lakes: Mendota, Monona, Waubesa. Devil's lake is a soft water lake, supplied from the Baraboo quartzite hills, about 40 miles north of Madison.

Oconomowoc-Waukesha group: North, Okauchee, Oconomowoc, Lac La Belle, all connected by the Oconomowoc River; Nagawicka and Nemahbin lakes are on the Bark river but not connected; Pewaukee lake is in the Fox river basin; Mouse, Pine, Silver lakes have no outlets.

Waupaca group: Beasley, Marl, Otter, Round.

Delavan and Geneva lakes are near each other and near the southern line of the state. Green lake (about 110 miles north of Geneva) is by far the deepest lake in the state and Geneva is next to it. These two lakes would in general be said to have greenish water. Of the rest, Marl and Round lakes have the peculiar tint of marly lakes. The others have water whose color, as seen from the shore, is determined partly by dissolved stains, partly by plankton, and is in general yellow-brown.

The dates given in the table with the various lakes represent the time when the sample of water was collected.

TABLE 5

COEFFICIENT OF ABSORPTION IN VARIOUS LAKE WATERS

Wave Length	Distilled Water	Allequash, X, 1914	Bass, X, 1914	Beasley, X, 1914	Beasley, VIII, 28, 1915	Bog Hole near Trout Lake, 1914	Delavan, VII, 20, 1915	Devils, VII, 17, 1915	Geneva, VII, 30, 1915	Green, X, 11, 1915	Lac la Belle, VI, 22, 1915	Marl, IX, 10, 1914
4700	.034	.....	.208	.984	.320	1.430	.306	.118	.324	.129	.415	.239
4940	.030	.883	.267	.824	.229	.957	.256	.102	.266	.120	.302	.206
5220	.030	.676	.190	.748	.208	.691	.239	.0998	.194	.103	.190	.195
5390	.022	.545	.206	.704	.203	.587	.227	.0716	.178	.104	.170	.185
5580	.036	.479	.210	.667	.202	.526	.211	.079	.153	.123	.178	.197
5790	.056	.460	.250	.662	.256	.498	.233	.166	.189	.148	.224	.227
5895	.096	.502	.284	.680	.317	.512	.262	.226	.246	.190	.243	.251
6005	.165	.525	.318	.725	.334	.541	.296	.275	.278	.225	.307	.294
6180	.206	.545	.338	.735	.348	.590	.331	.305	.337	.285	.358	.331
6360	.225	.546	.369	.745	.360	.613	.352	.316	.387	.369	.398	.335
6480	.236	.546	.390	.782	.389	.623	.383	.328	.404	.411	.427	.345
6630	.245	.581	.475	.841	.398	.651	.406	.384	.443	.432	.470	.368

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TABLE 5—Continued

Wave Length	Distilled Water	Marl, VIII, 23, 1915	Mendota, IX, 14, 1914	Mendota, VII, 15, 1915	Mendota, VIII, 16, 1915	Mendota, IX, 30, 1915	Mendota, XII, 18, 1915	Minocqua, X, 1914	Monona, IX, 14, 1914	Mouse, VI, 26, 1915	Nagawicka, X, 12, 1914
4700	.034	.100	.321	.259	.321	.312	.356	.584	.510	.201	.....
4940	.030	.099	.237	.186	.259	.250	.274	.520	.358	.184	.401
5220	.030	.108	.201	.146	.222	.202	.216	.470	.274	.142	.279
5390	.022	.108	.....	.141	.209	.187	.162	.427	.....	.103	.219
5580	.036	.107	.189	.153	.210	.161	.138	.398	.216	.128	.203
5790	.056	.149	.182	.199	.230	.188	.127	.395	.235	.206	.200
5895	.096	.201	.229	.239	.249	.264	.156	.404	.277	.256	.228
6005	.165	.223	.285	.243	.292	.318	.195	.434	.327	.281	.242
6180	.206	.254	.324	.294	.331	.360	.232	.444	.346	.298	.287
6360	.225	.276	.339	.356	.381	.393	.261	.441	.353	.309	.324
6480	.236	.315	.360	.374	.410	.417	.285	.428	.355	.340	.377
6630	.245	.398	.380	.376	.418	.438	.308	.421	.383	.390	.440

TABLE 5—Continued

Wave Length	Distilled Water	Nagawicka, VI, 26, 1915	Nemahbin, VIII, 21, 1915	North, IX, 27, 1914	North, VI, 26, 1915	Oconomowoc, X, 1914	Oconomowoc, VI, 26, 1915	Okauchee, X, 27, 1914	Okauchee, VI, 26, 1915	Otter, VIII, 23, 1915	Pond No. 1, near Trout L. 1914	Pewaukee, VIII, 21, 1915	Pine, VI. 26, 1915
4700	.034	.402	.510	.....	.824	.....	.565	.....	.558	.359	1.770	.443	.185
4940	.030	.329	.359	.....	.560	.478	.804	.643	.349	.285	1.281	.341	.142
5220	.030	.230	.312	1.358	.392	.393	.230	.489	.244	.254	.917	.302	.110
5390	.022	.205	.290	1.155	.292	.370	.184	.413	.197	.249	.734	.293	.114
5580	.036	.189	.290	.967	.256	.391	.211	.326	.181	.244	.608	.294	.118
5790	.056	.219	.319	.875	.295	.403	.240	.317	.250	.286	.598	.350	.129
5895	.096	.302	.378	.862	.354	.434	.279	.359	.297	.356	.562	.410	.153
6005	.165	.352	.430	.850	.390	.462	.301	.426	.312	.404	.579	.457	.171
6180	.206	.386	.452	.811	.425	.518	.321	.465	.334	.444	.552	.482	.205
6360	.225	.431	.483	.757	.454	.532	.369	.472	.389	.475	.526	.505	.232
6480	.236	.440	.520	.723	.476	.564	.380	.467	.434	.502	.499	.540	.249
6630	.245	.465	.575	.651	.543	.546	.418	.473	.450	.558	.495	.595	.316

TABLE 5—Continued

Wave Length	Distilled Water	Round, X, 1914	Round, VIII, 23, 1915	Silver, VI, 26, 1915	Superior, IX, 19, 1914	Swamp near Trout L., X, 1914	Trout, X, 11, 1914	Turtle, IX, 18, 1914	Turtle, IX, 3, 1915	Waubesa, VIII, 11, 1915	Waubesa, X, 2, 1915
4700	.034	.....	.308	.202	.241	1.130	.222	.....	.....	.460	.530
4940	.030	.452	.287	.202	.194	.831	.188	.....	.....	.312	.408
5220	.030	.361	.282	.190	.160	.648	.150	1.724	1.900	.235	.290
5390	.022	.348	.276	.142	.148	.565	.142	1.363	1.580	.218	.242
5580	.036	.331	.299	.141	.164	.428	.122	1.122	1.300	.243	.255
5790	.056	.335	.348	.224	.156	.422	.129	.900	1.070	.293	.276
5895	.096	.343	.408	.274	.209	.423	.175	.858	1.015	.313	.281
6005	.165	.372	.444	.328	.238	.420	.212	.833	.958	.344	.309
6180	.206	.395	.517	.359	.272	.438	.248	.775	.925	.357	.320
6360	.225	.405	.558	.367	.287	.392	.278	.672	.879	.366	.311
6480	.236	.428	.588	.395	.305	.362	.296	.620	.859	.380	.306
6630	.245	.426	.596	.452	.348	.313	.340	.580	.828	.412	.287

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Coefficient of Absorption in Various Lake Waters

Notes on the Foregoing Paper

E. A. Birge

In the foregoing report, Dr. Pietenpol has stated his results rather in the terms of a physical experiment than in those of limnology. I, therefore, add a few notes bearing on the limnological results obtained from them.

The investigation was carried out by Dr. Pietenpol at my request. Its results serve two ends; first, they show the absorption of light in Wisconsin lakes by colored matters dissolved in the water, and, second, they offer one part of the data by which the absorption of solar energy in the surface strata of lakes may be distributed, approximately, among its three chief factors—the selective absorption of water itself, selective absorption due to color of water, and absorption due to suspended particles. The latter purpose was the more important one, but is not considered in this paper.

The first, and thus far, I believe, the only student to apply spectrophotometric methods to lakes, was von Aufsess.[1]. By means of a skillful adaptation of the instrument to use in a boat and with great labor, he studied the water of ten Bavarian lakes *in situ*. He determined their absorption curves and he classified the lakes, as a result of his observations, into four types; 1, blue; 2, green; 3, yellow-green; 4, yellow or brown. He also reached conclusions regarding the nature of the color of pure water and other matters, which do not concern us here.

Observation with the spectrophotometer on the lake itself demands so many simultaneous favorable conditions that good opportunities are rare. In the case of the Walchensee, von Aufsess had to wait four weeks for his observations. This difficulty is very likely one reason why no one has followed him along so promising a line of study.

It was plain that methods dependent on such exceptional weather conditions were not at all adapted to reach the ends sought by this survey. It was determined therefore to work in the laboratory, not on the lake; and also to make use of filtered

[1] von Aufsess, O. Die Farbe der Seen. Inaugural Dissertation, Munich. 1903.

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water. This conclusion was based at first on the experience of von Aufsess ('03, p. 30) who found that suspended matters did not alter the form of the absorption curve of the lake. It was confirmed by Pietenpol's comparisons of filtered and unfiltered water, some of which are recorded on p. 574.

There is, therefore, apparently a fundamental difference between the observations of von Aufsess and Pietenpol, one set being made on the lake itself and the other on filtered lake water. But in fact the results of the two methods are comparable, except in one particular. The particles in suspension decrease the amount of light transmitted though they do not, in general, alter its color. The position of the curve of absorption is changed in the two methods, but not its form. This must be kept in mind in comparing von Aufsess' curves with those of this paper. Since the amount of suspended matter is a very variable one, the degree of weakening of the transmitted light due to it, is correspondingly variable; and since the investigation concerns primarily the color rather than the total quantity of transmitted light, it is an advantage to eliminate the suspended particles. It is certain, for instance, that in von Aufsess' observations every coefficient of absorption has been determined by two kinds of factors, first the selective absorption of water and stain, and second, the non-selective action of suspended particles. It is impossible to tell how much is attributable to each of the factors. In Pietenpol's method, the selective absorption alone is considered, and the non-selective absorption can readily be determined by other methods if it is desired. In any case, the spectrophotometer is not a good instrument for the latter purpose.

Suspended matters may greatly modify the color of lakes as seen from the shore. The apparent color of the water is affected by the light reflected from particles in suspension. Marly lakes have a peculiar bluish-green tinge, due in part to light reflected from the white particles of marl. Lakes whose plankton is abundant acquire a brownish shade when a crop of diatoms comes up, and a different color when filled with *Ceratium*. These influences are eliminated by the process of filtration. But they are also eliminated by any scheme which determines the color of a lake by means of light transmitted through the water, either directly, or (as in von Aufsess' case) reflected from a white disc. However this process may be

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carried out, the direct illumination or the light from the disc entirely overpowers the feeble rays reflected from suspended particles. Any scheme of determining the color of lakes which depends on color comparators or on the use of white discs lowered into the water, practically eliminates from consideration that part of the color which is due to reflection from suspended particles.

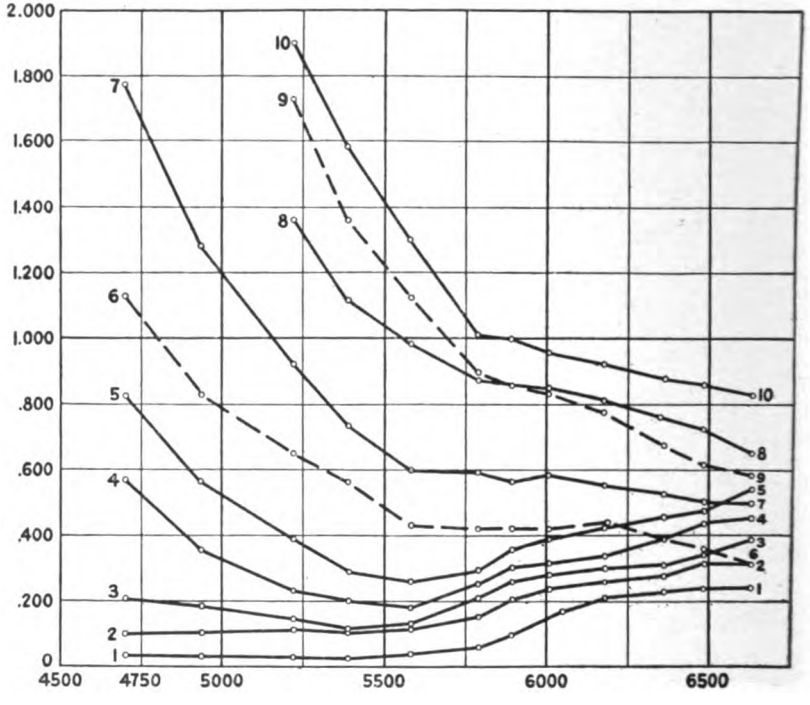

Fig. 7. Typical absorption curves from table 5. The wave lengths are platted on the horizontal axis and the coefficients of absorption on the vertical axis. The curves are as follows: 1. Distilled water; 2. Marl lake; 3. Mouse lake; 4. Okauchee lake; 5. North lake, 1915; 6. Swamp near Trout lake; 7. Pond No. 1; 8. North lake, 1914; 9. Tutrle lake, 1914; 10. Turtle lake, 1915.

It must also be said that most of von Aufsess' work was done on lakes which are not rich in plankton. His most transparent lakes show a coefficient of absorption quite as low as Pietenpol's most transparent filtered water.

The general form of the absorption curves from the Wisconsin lakes is similar to that of those examined by von Aufsess.

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Marl lake furnishes the most transparent water, which is much like that of Walchensee. At the other end of the scale, Turtle lake is much more highly colored than Arbersee, the most deeply tinged of those examined by von Aufsess. For these curves see table 5 and fig. 7, and compare them with von Aufsess' tables and plates.

Illustrations of curves from Wisconsin lakes are given in fig. 7 in which are platted typical curves from the series of lakes, ranging from the clearest water to the most highly colored.

No lake in the series shows the smallest absorption at the blue end of the curve. None of them, therefore, can come into von Aufsess' class of "blue lakes"[1] ('05. p. 89) although Marl lake comes very close to it. In most cases of the clear waters, however, there is a minimum of absorption about 5400–5600 Å, in the green, and the water would therefore agree with von Aufsess' second type—the "green lakes." In by far the great majority of the Wisconsin lakes, the water is decidedly stained by dissolved coloring matters, and there is a strong increase of absorption toward the blue end of the spectrum. The water has, therefore, a color varying from yellowish green to brown according to the depth of the stain.

In the most highly colored waters, like that of Turtle lake, there is no minimum of absorption in the yellow or green, or at most only a hint of such a minimum. The blue is wholly absorbed and the coefficient of absorption falls off rapidly through the green to about 5800 Å, and much more slowly at greater wave lengths.

It is, therefore, obvious that all the Wisconsin waters are more or less stained with extractive matters. An attempt was, therefore, made to correlate the selective absorption with the color as ascertained by the use of the United States platinum-cobalt scale—a scale devised especially for use on such waters.[1]

The water of 21 lakes was examined in 1915 with results as shown in the following table:

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[1] von Aufsess, O. Die physikalischen Eigenschaften der Seen. Braunschweig, 1905.

[1] Leighton, M. O., Field Assay of Water. U. S. G. S. Water-supply Bull., Series L, No. 11. Washington, 1905. p. 42.

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TABLE 5

Color	Lakes
6---	Beasley, Green, Marl, Trout.
8---	Devils, Geneva, Delavan, Mendota, Round.
14---	Mouse, Nagawicka, Pine, Otter, Silver.
18---	La Belle.
22---	Oconomowoc, Okauchee, Waubesa.
35---	North.
45---	Bog Water, near Trout lake.
93---	Turtle.

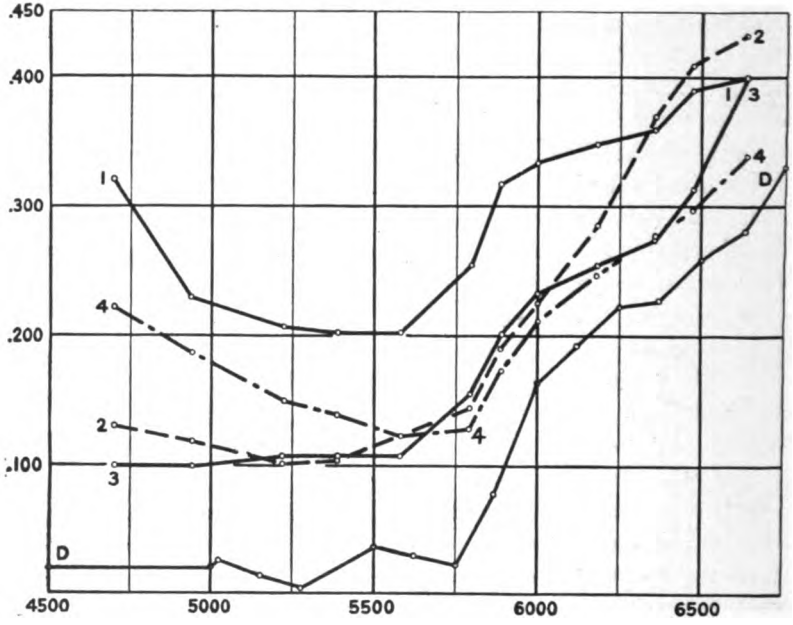

Fig. 8. Absorption curves of lakes rated 6 on the platinum-cobalt scale of color. 1. Beasley lake; 2. Green lake; 3. Marl lake; 4. Trout lake. In figs. 8–13 the scale for coefficients of absorption is made very large in order to bring out differences and resemblances in the curves without confusing their lines. In all of these diagrams the absorption curve of distilled water is marked D.

The results of the spectrophotometer observations on these lakes are shown in figs. 8–11. Fig. 8 shows the absorption curves for the four lakes whose color was 6 on the platinum-cobalt scale. It is plain that these lakes belong in two classes. Beasley and Trout lakes show an absorption that increases

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rapidly in the shorter wave lengths, while Green and Marl lakes belong together, with an absorption which does not increase at all, or only very little for wave lengths shorter than 5500Å.

The same fact is shown in the lakes whose water was rated at 8, as shown in fig. 9. Three of these lakes, Delavan, Geneva and Mendota, belong together, and have a great increase of absorption in the shorter wave lengths. Devils lake shows a

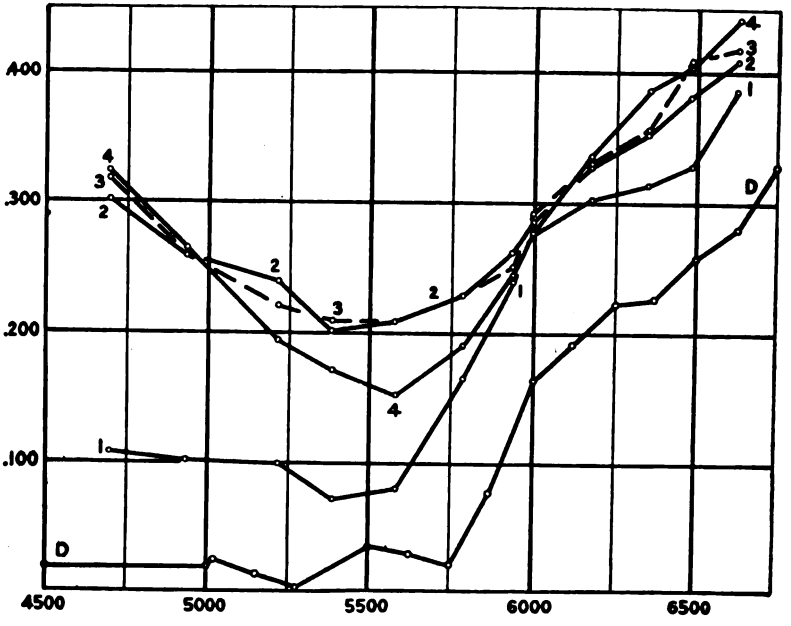

Fig. 9. Absorption curves of lakes rated 8 on the color scale: 1. Devils lake; 2. Lake Geneva; 3. Delavan lake; 4. Lake Mendota.

coefficient of absorption in this region quite as low as any of those rated at 6. Round lake is not shown on the diagram, but is found on fig. 13. It belongs to the same type as Devils lake in the relative absorption of shorter waves, but has a far greater coefficient of absorption at all wave lengths. It constitutes a peculiar case which is later discussed.

The lakes rated at 14 also fall into two classes. Nagawicka and Otter lakes agree in having a rapidly rising absorption toward the blue end of the spectrum, while in Monona, Pine,

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and Silver lakes the coefficient of absorption rises very slowly in this region.

All of the lakes rated at 18–22 have closely similar curves of the first type.

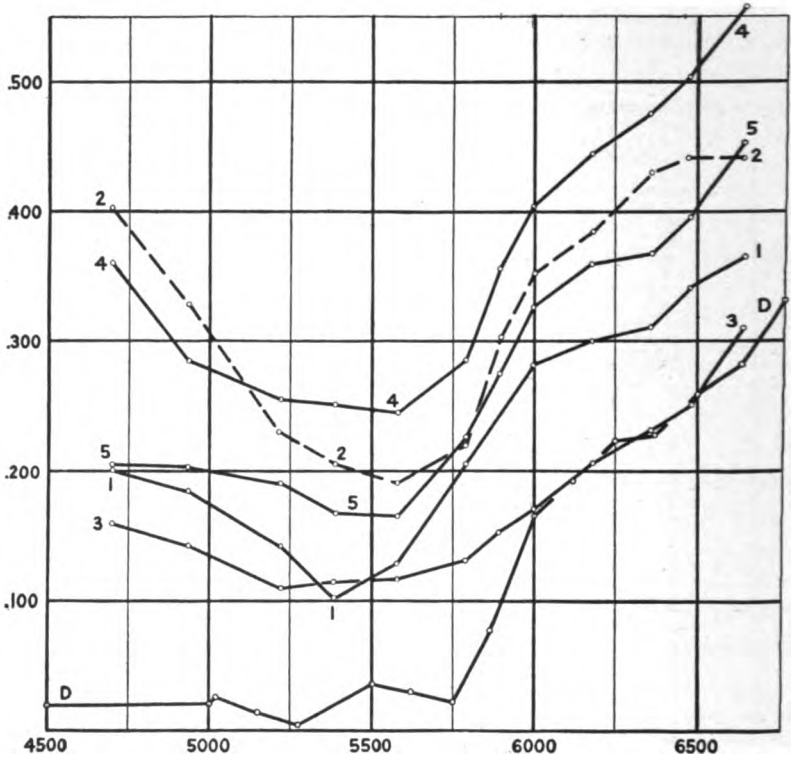

Fig. 10. Absorption curves of lakes rated 14 on the color scale: 1. Mouse lake; 2. Nagawicka lake; 3. Pine lake; 4. Otter lake; 5. Silver lake.

Thus the discrepancy between rating on the platinum-cobalt scale and the form of the absorption curves is most conspicuous in the lower numbers of the scale. It means two things; first, that it is not easy to apply the scale exactly to these low colored waters. Probably, Devils lake might have been rated somewhat lower than 8 with equal or greater accuracy. Second, and far more important, the platinum-cobalt scale, like any other scale for rating colors of lakes, matches the color of various waters with varying degrees of accuracy. Doubtless, the matching for this scale is most correct in the lakes with

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high absorption in the blue end of the spectrum, for which it was devised.

The color of the water is due in all cases to extractive matters and these are numerous, complex, and vary not only in amount, but also in kind and number from lake to lake, and in the same lake from time to time. No one scale or standard can, therefore, represent them with accuracy—as von Aufsess showed for the methyl blue and potassium chromate scales ('03, p. 36–38.)

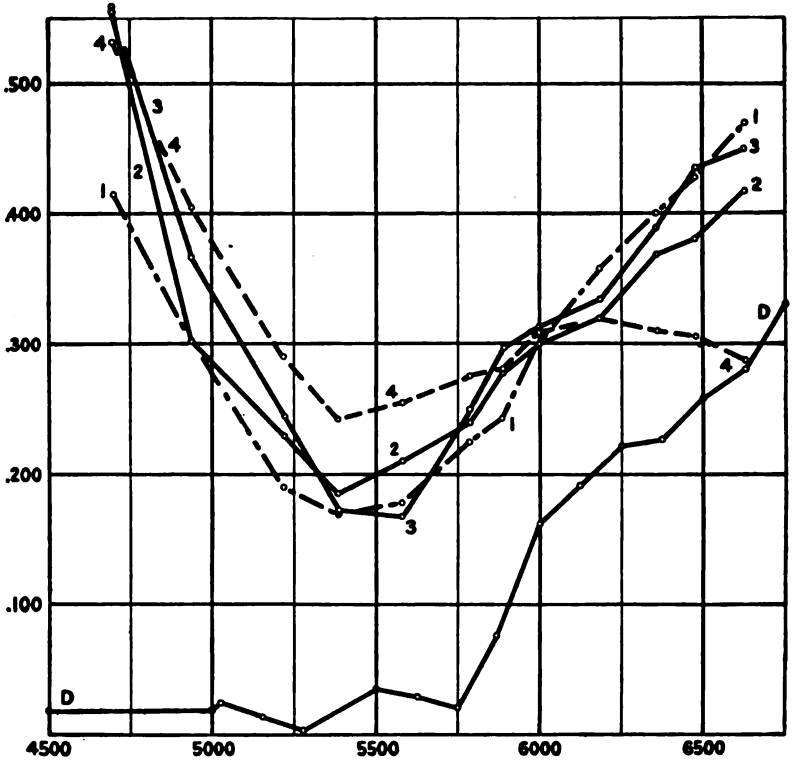

Fig. 11. Absorption curves of lakes rated 18–22 on the color scale: 1. Lac la Belle; 2. Oconomowoc lake; 3. Okauchee lake; 4. Lake Waubesa.

In general, therefore, the water of the following lakes seems to have a kind of color which the spectroscope shows to depend on a mixture of similar stains, and the difference in intensity seems to depend essentially on the quantity of absorption due to these stains in the region toward the blue end of the spectrum

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where the wave lengths are shorter than 5500Å. The absorption curves are in so close agreement in the region below 5800Å that no difference in color can fairly be attributed to differences of absorption at that end of the spectrum.

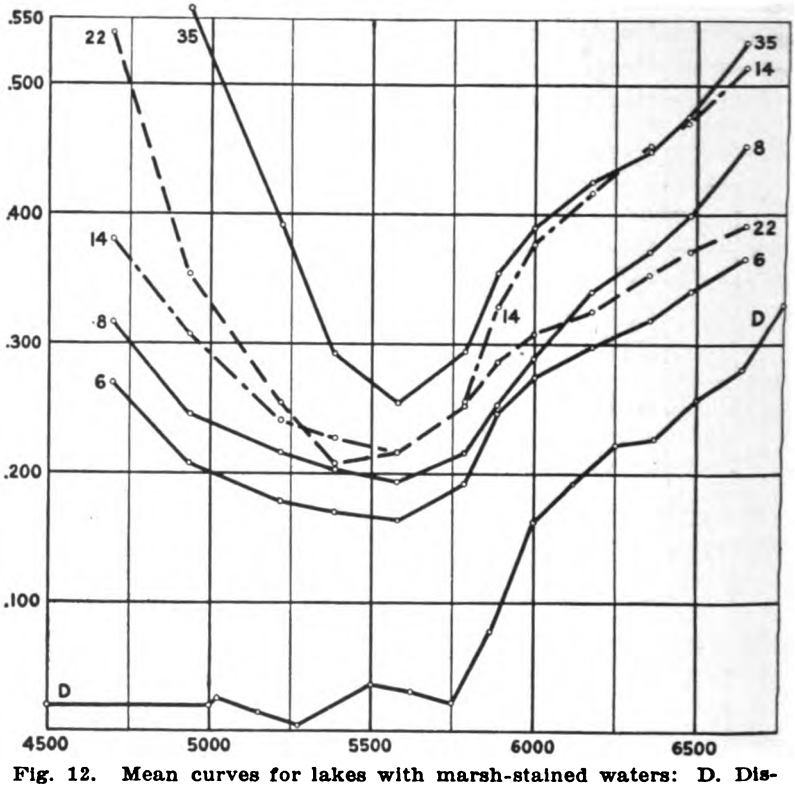

Fig. 12. Mean curves for lakes with marsh-stained waters: D. Distilled water; 6. Beasley, Trout lakes; 8. Delavan, Geneva, Mendota; 14. Nagawicka, Otter; 22. Oconomowoc, Okauchee, Waubesa; 35. North lake. In this lake absorption at 4700 is .824.

TABLE 6

Color	Lakes
6---	Beasley, Geneva, Trout.
8---	Delavan, Mendota.
14---	Nagawicka, Otter.
18---	Lac La Belle.
22---	Oconomowoc, Okauchee, Waubesa.
35---	North.

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To the same general type belong Turtle lake (rated at 93) with the Bog Hole near Trout lake (rated 45), Allequash lake, Swamp near Trout lake, Nemahbin. The last three were not examined for color.

In a similar way the absorption curves seem to show that the color of the following waters are due to a mixture of stains somewhat similar to each other and different from that which dominates the former set of lakes.

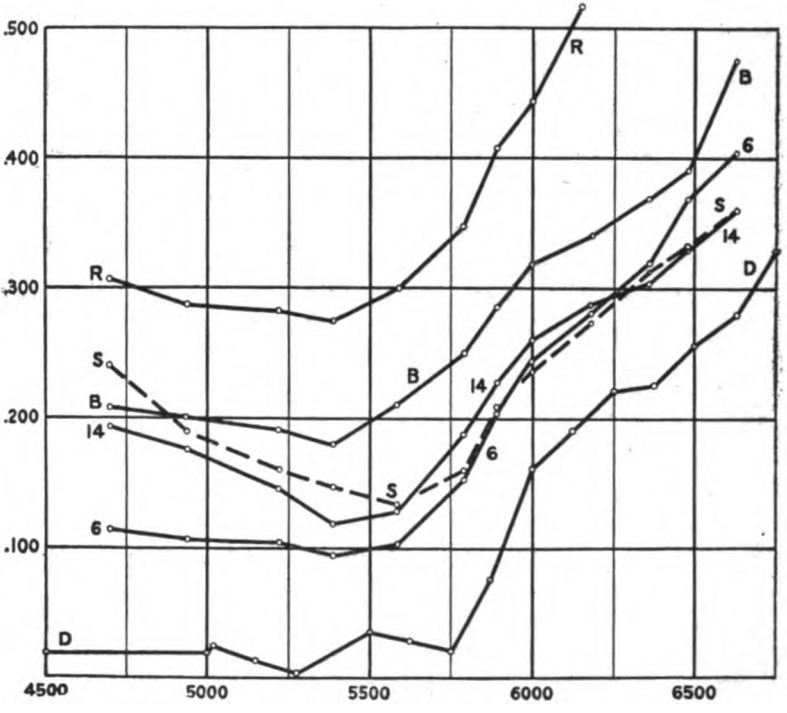

Fig. 13. Mean curves for lakes of second type. 6. Devils, Green, Marl; 14. Pine, Mouse, Silver. Also unrated lakes. B. Bass lake; R. Round lake, 1915; S. lake Superior.

TABLE 7

Color	Lakes
6–8___	Devils, Green, Marl.
14___	Mouse, Pine, Silver.

The absorption curves of this type are not as similar as those of the first set; but they show a general agreement, as inspec-

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tion of fig. 13 will show. To the same or a similar series belong Bass and Minocqua lakes, and lake Superior (fig. 13) whose color has not been rated.

It is not without significance that the lakes named in the two tables may be divided into the same two sets by physical conditions as well as by color. The lakes of the first group receive a considerable amount of drainage from streams which pass through marshes or they have a good deal of marsh drainage from their borders. The lakes of the second set except Green lake, have no tributaries, and except Green and Marl, have no outlet. They are isolated spring-fed lakes and receive little or no marsh water.

The contrast in the curves of Green lake and lake Geneva is an interesting one in view of the general similarity of the lakes. The latter lake receives at its western end a large amount of spring water which filters through great beds of cress and through marsh. No such supply from marshes reaches Green lake and the notable difference revealed by the spectroscope probably depends on this difference in water supply. The tributaries of Green lake in general flow through a cultivated farming country and not through marsh.

The lakes included in table 6, therefore, agree in receiving water stained by marshes. Their waters may therefore be called *marsh-stained waters.* One would be inclined to make the name more specific and call them *peat-stained waters,* but such designation would go beyond our present knowledge. For lakes of the second type no name can be found at present.

The absorption curves for eleven of the lakes belonging to the type with marsh-stained waters, have been put together on fig. 12, averaging them according to color rating. The curves for lakes rated in color as 6, 8, 14 and 35, show the relation which might be expected, so far as wave lengths below 5500Å are concerned. The curve for color 22, however, shows a decidedly smaller minimum absorption at 5400Å than the lakes with lower color. This relatively small minimum absorption is common to Okauchee and Oconomowoc lakes and is shared by Lac La Belle (fig. 11, color, 18) and also by North lake (color, 35). All of these lakes are on the same stream, North lake being the highest and Okauchee, Oconomowoc, and La Belle following in order. They show colors of similar type and of decreasing intensity through the series. They differ in this re-

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gard from the other lakes shown in the same diagram and also from Waubesa (fig. 11) which more closely agrees with the general type in this part of its curve.

It appears that the color of these lakes is due primarily to a stain—or a mixture of stains—which rapidly absorbs the rays at the blue end of the spectrum. In the less powerfully colored waters—rated from 6 to 35—there seems to be a direct relation between intensity of color on the platinum-cobalt scale and the coefficient of absorption at 4700Å and 5000Å. Between the limits of 6 and 35 on the color scale the coefficient of absorption at 4700Å rises from about .275 to .825, rising in almost a straight line. Each degree on the color scale adds about .018 to the coefficient of absorption. This relation is shown by eleven lakes in six widely separated drainage basins. It would be interesting to learn whether a larger series would show the same relation.

If the absorption curves for wave lengths below 5500Å are studied, they disclose a very different set of facts from those shown by the same curves for shorter wave lengths. Consider first the lakes with marsh-stained water, as shown in fig. 12. The absorption curve for pure water begins to rise rapidly from about 5750Å and in general rises steadily throughout the remainder of the spectrum shown in the diagram. There is a halt in the rise at about 6220–6300Å. The same feature was found by von Aufsess in one of his observations on pure water and in one lake. No readings were made at this wave length by Pietenpol and his readings at 6180Å and 6360Å give no indication of such a feature as von Aufsess' curves show. ('03, plate 1).

In general these absorption curves for lake water show a minimum anywhere from 5400Å to 5600Å and a rather rapid and regular rise in absorption as the curve passes to greater wave lengths. The curve at wave lengths below 5750Å is roughly parallel to that of pure water. If a constant sum is added to the coefficient of absorption of pure water the result will give with fair accuracy the form of this part of the curves. The observations of von Aufsess ('03, plate 1) show the same fact.

Furthermore, there is no such correlation between intensity of color and coefficient of absorption as there is at the other end of the spectrum. The mean absorption at greater lengths than 6100Å is lowest in lakes rated at 22. This is due in part

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to the singular behavior of lake Waubesa in this region, but if this lake were omitted the others would be at least no higher than the lakes rated 6 and 8. We must, therefore, conclude that the colors of these waters do not depend in any essential way on the selective absorption of the longer waves of light.

The same relation is found in the lakes of the second type as shown on fig. 13.

It appears, therefore, that all of these lakes possess stains in general which raise the coefficient of absorption in the longer wave lengths much above that of pure water, but which do not essentially modify the selective absorption within the range of the spectrum included in the observations.

Certain exceptions must be made to the above statement. Pine lake alone among those observed has a curve below 6005Å which is practically identical with that of pure water, in spite of its color rating of 14. This case strongly confirms the rule given above, so far as selective absorption in this region is concerned. Lake Waubesa (see fig. 11 and table 4) is a very conspicuous exception. The coefficient of absorption rises in the region from 5390Å to 6180Å and thence declines rapidly and steadily to 6630Å where it is but little above that of pure water, being .287 while pure water is .245. This condition seems to show that Waubesa lacks in whole or in great part a stain which is present in the other lakes whose absorption at the other end of the spectrum is quite similar to that of Waubesa. Minocqua lake also shows a decline of absorption from 6005Å on, but it is always much greater than that of pure water.

While these two cases stand alone in the series of lakes that have been examined, there are hints of something of the same kind elsewhere. Oconomowoc lake shows a decline between 6480Å and 6630Å in the observation of 1914, and perhaps the corresponding observation on Okauchee lake may bear a similar interpretation. Round lake in both years shows an absorption coefficient nearly stationary between 6480Å and 6630Å, though a very high one.

When we pass to consider lakes of high color, 47 and above, on the platinum-cobalt scale, the absorption curves below 5750Å are quite different from those discussed above (see fig. 7). The waters concerned are partly swamp and bog waters from the northern part of the state: viz., Bog, Swamp, and Pond

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near Trout lake; they are partly from lakes, Turtle lake in the northern part of the state, and North lake (1914), a member of the Oconomowoc-Waukesha group. In these six waters the more deeply stained show a steady decline in the coefficient of absorption from 5750A on and consequently an approach to the absorption of pure water. The less deeply stained show an absorption which is practically stationary through this part of the spectrum. The "swamp" water shows a phenomenon quite parallel to that of Waubesa; from 6180Å on the absorption declines and at 6630Å is practically identical with that of Marl lake—one of the clearest waters—and is but little above that of pure water.

The case of Round lake deserves a word to itself (see fig. 13). This is one of the Waupaca lakes and is of the marly type. Its water is of the same type as those of Green, Marl, etc., but with a far higher amount of absorption. This is true for both years in which it was observed. It constitutes a unique and, so far as present data go, an inexplicable case among the lakes studied.

These notes show part of the limnological conclusions which may be drawn from Dr. Pietenpol's data. It is plain that the observations on which they are based constitute the beginning of a large investigation rather than its completion. They show that the study of lake waters by the spectrophotometer may enable us not only to group them into large classes, as von Aufsess did, into "blue lakes," "green lakes," etc., but also to classify them more accurately according to the various kinds and mixtures of stains which color the water and which give rise to different forms of absorption curves. The observations here recorded indicate at least one well marked variety of the yellow-brown waters—that which I have called the marsh-stained—and also that this type of curve differs widely from that offered by other types of lakes with colored waters.

These notes, however, indicate rather the possibilities of such a study than any final or complete results. This Survey is not likely to carry the investigation further at present, since it is a slow and laborious one and the data already obtained are sufficient for the primary purpose with which it was undertaken—that of ascertaining the general facts regarding the absorption of the sun's energy by the surface strata of lakes.

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A BIOCHEMICAL STUDY OF THE PLANKTON OF LAKE MENDOTA

HENRY A. SCHUETTE

Notes from the Laboratory of the Wisconsin Geological and Natural History Survey. XIII.

INTRODUCTION

The fact that the plankton of rivers, lakes and seas forms a not inconsiderable portion of the food of the aquatic life therein, and especially of the fishes, prompted a study undertaken several years ago by the Natural History Division of the Wisconsin Geological and Natural History Survey to determine the biochemical nature of the plankton of the inland lakes of Wisconsin and with particular reference to Lake Mendota.

The nature of a plankton catch is dependent upon meteorological conditions and is subject to seasonal variations. It was therefore necessary in this study to make frequent catches and to examine each catch biologically and chemically. The immediate cause for the investigation here recorded is the necessity of a preliminary survey whose methods would be adaptable to the general study of the larger subject at hand. It was felt that by a critical examination of several catches typical of the entire series, we would have at hand data which would lead to an insight into the biochemical nature of fresh water plankton. Data are available concerning marine plankton.[1] While in-

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[1] K. Brandt. Beitrage zur Kenntnis der chemischen Zusammensetzung des Planktons. Wissen. Meeresunters. Abteil. Kiel. N. F. III, (1898), 45–90. R. Volk, Hamburg. Elb. Unters. VIII, (1906).

H. Kylin, Untersuchungen ueber die Biochemie der Meeresalgen. Z. physiol. Chem. 94, 337–425 (1915).

König, J., and J. Bettels, Die Kohlenhydrate der Meeresalgen und daraus hergestellter Erzeugnisse. Z. Nahr.-Genussm. 10, 457, (1905).

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dividual algal specimens have been examined chemically by Hyams and Richards,[2] by Turner[3] and by Whipple and Jackson,[4] so far as is known to the writer this is the first attempt in this direction in which composite catches of fresh water plankton have been examined from a chemical standpoint.

Material

During the period extending from October 25 to December 3, 1913, five catches were obtained which were considered typical of the various kinds of plankton collected during the survey. Soon after the ice left Lake Monona in the following spring a favorable opportunity presented itself for the collection of a catch of crustacea which consisted entirely of Daphnia. These were then included in this study for comparative purposes. To date about four hundred plankton catches have been made. The collecting season begins soon after the ice leaves the lakes and closes shortly before the freeze-up.

All samples were collected by two methods: first, by pumping up water from different levels of the lake and straining it through a plankton net, and, second, by using tow nets. In the former a fairly large volume of water was pumped through two rubber hose immersed at varying depths below the surface. One tube was immersed just below the surface and the other one meter down. With the hose in these positions the water was pumped for ten minutes. The hose were then immersed two meters deeper and the pump again operated for ten minutes. This successive change of level was made until a depth of twenty meters had been reached which was as near the bottom of the lake at the station where all pump catches were made as could be made without danger of contamination with mud. As the water left the pump it was strained through a very fine bolting cloth plankton net. The material was concentrated in the bucket of the net and was then washed into a jar with distilled water. Representative samples of the material were re-

[2] Isabel F. Hyams and Ellen H. Richards, Notes on Oscillaria prolifica (Greville). Technology Quarterly 14, 302, (1901); 15, 308 (1902); 17, 270 (1904).

[3] B. B. Turner, The chemical composition of Oscillaria prolifica. J. Am. Chem. Soc. 38, 1402–1417 (1916).

[4] Geo. C. Whipple and D. D. Jackson, Asterionella: its biology, its chemistry and its effect upon water supplies. Jour. N. E. Water Works Assoc. 14, 1–25 (1899).

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moved for biological studies, a little chloroform was added to the remainder of the catch as a preservative, and it was then taken to the laboratory for evaporation.

The other method consisted of towing behind a boat a net of coarser bolting cloth than was used in connection with the pump. Cloth of the texture used allowed the greater part of the plant matter to pass through and retained the crustacea which are larger organisms. The nets were weighted down so that they sank to a level of about five feet below the surface.

The history of the plankton catches examined follows:

Sample	Date of collection	Source	Method of collection
	1913		
A	Oct. 11 — Oct. 25	Mendota	Pumping
B	Oct. 4 — Nov. 1	Mendota	Pumping
C	Oct. 18 — Nov. 5	Mendota	Tow nets
D	Nov. 1 — Nov. 5	Mendota	Tow nets
E	Dec. 3	Mendota	Skimming
	1914		
154	April	Monona	Tow nets
	1915		
5138	Sept. 18 — Oct. 2	Mendota	Tow nets

It will be noticed that samples "A" to "D" inclusive and 5138 are composites of the catches from a number of days, a microscopical examination having shown that they contained the same organisms and for this reason they were mixed. Sample "A" consists of a series of pump catches made in deep water; it contains a preponderence of vegetable matter. The diatom Fragilaria predominates. The next most abundant alga is Microcystis. A fairly large number of crustacea are present. Sample "B" is a composite of pump catches made at the shore and therefore in shallow water; it contains a greater proportion of plant material than the preceding sample, Fragilaria again being the chief constituent. Microcystis is rather common. A few crustacea are present. Samples "C" and "D" are tow net catches made in the deeper waters of Lake Mendota; they consist chiefly of animal matter in which the crustacea predominate. Daphnia, Diaptomus and Cyclops constitute by far the greater part of the material in sample "C." The

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most abundant alga is Fragilaria. Daphnia constitutes by far the greater part of the material in sample "D," a few copepods and very little plant material being present. Sample "E" consists almost entirely of two blue-green algae, viz., Aphanizomenon and Anabaena, which were found floating near the shore of the lake. Sample 154 consists of Daphnia pulex. Sample 5138 is not very different biologically from samples "A" and "B." The chief plant constitutent is Fragilaria while Daphnia is the chief animal constituent. It was not subjected to the same analyses and examination as the other catches of this series. It was particularly examined for the presence of carbohydrates.

Our method of preparing the samples for analyses was to evaporate them in shallow dishes on a water-bath, kept below 60°C., almost to dryness and to finish the operation in a vacuum oven at 65° C. over calcium chloride. Drying was complete in about 72 hours from the time that the samples reached the laboratory. The resulting residue could easily be ground in an ordinary meat grinder. The ground mass was then put through a small mesh sieve and the larger particles further comminuted in an agate mortar. The dry weight of the catches follows:

Sample	Weight
A	53 grams
B	28 "
C	187 "
D	160 "
E	470 "
154	92 "
5138	125 "

The dried plankton was rather hygroscopic, taking up about four per cent of moisture during the process of grinding. For this reason, all samples weighed out for analysis were again dried and the results calculated to a moisture-free basis. It was found by experiment that drying for twelve hours in an electric oven kept at 60° C. was sufficient to bring the sample to constant weight.

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Proximate Analysis

Ash and silica. The inorganic substance of all the catches was determined by first carbonizing the material under examination with a small flame. Ashing was then completed in an electric muffle furnace at a temperature of 500° to 600° C. The plant catches as a rule show the highest ash content. The algal catch "E" has a much lower ash content, however, then might be expected by analogy with samples "A" and "B."

The ash was taken up with dilute hydrochloric acid, heated on the steam-bath and the siliceous residue filtered off. In order to remove any silica which might have passed into the filtrate, the latter was evaporated to dryness, dried at 120° C., again taken up in hydrochloric acid, heated, and filtered through the same filter as before. The residue was then burned, weighed, treated with sulphuric and hydrofluoric acids in the usual way, evaporated and ignited, and the loss in weight calculated as silica.

The ash and silica contents are tabulated below:

Sample	Ash	Silica[1]
A	26.05	17.90%
B	27.16	20.82
C	13.98	2.37
D	14.51	0.70
E	6.52	0.17
154	7.62	0.07
5138[2]	41.44	24.37

Ether extract. All samples were extracted with washed anhydrous ether in a Soxhlet extraction apparatus for twenty-four hours, the extract filtered into a tared dish, the ether allowed to evaporate spontaneously, the residue dried over sulphuric acid and weighed. The extracts obtained from the plant catches "A," "B" and "E" were quite unlike those obtained from the crustacea catches "C" and "D" and the Daphnia catch, number 154, which had all the physical characteristics of an oil. The odors of the latter were decidedly those of a fish oil. The ether extract from the Daphnia catch solidified on exposure to the air, a fact which differentiates it from the

[1] Silica determinations by A. J. Duggan of the Survey.
[2] Determination by N. A. Bailey of the Survey.

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others. The crustacea extracts deposited crystals of glycerides after standing for twelve hours. Viewed by polarized light between Nicol prisms under a magnification of 56 diameters, they showed a crystalline structure and when a selenite plate was interposed between the prisms, the characteristic play of colors was observed.

The following analytical results were obtained:

Sample	Ether extract
A	9.88%
B	10.08
C	8.01
D	13.47
E	4.34
154	21.25
5138	7.61[1]

After standing over sulphuric acid for two months, the oils from the Daphnia and the crustacea catches were examined for their physical and chemical constants. The nature of the residues found in the ether extracts from the plant catches made it inadvisable to attempt the determination of similar constants. The volatile acids, both water-soluble and water-insoluble as expressed by the Reichert-Meissl and Polenske numbers respectively, the iodine number according to the method of Hübl, the saponification number and the index of refraction with the Abbé refractometer were determined. They are recorded in the following table.

Sample	C	D	154
I. R. at 25° C.	1.4777	1.4785	1.4810
Iodine No.	102.08	87.58	172.88
Saponification No.	-----	248.60	208.56
Reichert-Meissl No.	-----	1.16	0.94
Polenske No.	-----	1.55	1.22

Extraction with purified 95% alcohol of material which had been exhausted with ether showed that there is left much that is soluble in alcohol. Samples "C," "D" and "E" were first extracted quantitatively with anhydrous ether and then with alcohol. The amount of alcohol-soluble residue obtained by

[1] Determination by N. A. Bailey of the Survey.

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extraction under the conditions outlined above, when calculated on the original is as follows:

Sample	Soluble in alcohol
C	39.58%
D	45.73
E	20.07

Crude fiber. The amount of crude fiber was determined by the method of digestion for half-hour periods with sulphuric acid and sodium hydroxide solutions of specific gravity 1.25, filtering on tared Gooch crucibles, washing, drying at 100° C., and ignition. We found that this determination can be expedited by completely washing out the alkali with hot water after the last digestion and then washing the residue from the linen filter with a small volume of hot water into a 100–c.c. beaker. After allowing the residue to settle, which takes but a short time, the solution is decanted through the Gooch crucible and then the residue is washed from the beaker with a small quantity of water. This procedure permits of the rapid filtration of a solution which otherwise invariably clogs the filter.

A close agreement was found between the amounts of crude fiber contained in the crustacea catches, but a rather wide variation among the plant catches. The algal catch contains less crude fiber than any of this series. The crude fiber content calculated on a dry basis is as follows:

Sample	Crude fiber
A	4.58%
B	2.61
C	5.40
D	5.63
E	1.30
154	3.33
5138	2.13

The crude fiber obtained in each case was found to contain nitrogen. This nitrogen is not part of the proteins inasmuch as they are hydrolyzed during the treatment, the products of hydrolysis being soluble and going into the filtrate. It must be considered as one of the forms of the nitrogen-containing

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substances which is indigestible in this method of determining the crude fiber. Volk[1] in making a biological survey of the plankton of the Elbe River in Germany in the summer of 1904 considered this nitrogen as a constituent of the indigestible "Chitin und Muskelsubstanz" of the plankton which he examined. He boiled the defatted sample under examination with strong potassium hydroxide solution and weighed the resulting residue, reporting it as "Chitin und Muskelsubstanz" (including certain salts.) He apparently made no attempt to remove the latter by digestion with dilute acid.

We determined the amount of nitrogen in the crude fiber by the Kjeldahl-Gunning-Arnold method and found that it fell within the limits of the nitrogen content reported by various investigators working on chitin from various sources.

The nitrogen found in the crude fiber is as follows:

Sample	Nitrogen calc. on crude fiber	Nitrogen calc. on original
A	5.94%	0.27%
B	6.75	.17
C	7.47	.42
D	7.47	.42
E	7.25	.09

There are tabulated below for comparison the nitrogen content of chitin reported in the literature.

Reported by	Source	Nitrogen
Schmidt [2]		6.53%
Schlossberger [3]	langusta	6.50
Peligot [4]	silk worms	6.15—8.30

[1] Loc. cit.
[2] Ann. Chem. Pharm. 54, 298 (1845).
[3] Ibid., 98, 115–120 (1856).
[4] Compt. rend. 47, 1034–1039 (1858).

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Reported by	Source	Nitrogen
Stadeler [1]	Astacus fluviatilis	6.14%
Rutschli [2]		7.40
Lelman [3]		5.59
Ledderhose [4]	crustacea	7.00
Krukenberg [5]	cuttle fish (?)	7.37
Araki [6]		6.01–6.39
Gilson [7]		6.17
Iwanoff [8]		8.22
Offer [9]		7.22
Scholl [10]	Boletus edulis	6.03
Brach [11]	crab shells	6.66

Total sulphur. Total sulphur was determined in six catches. The sample under examination was fused with sodium carbonate and sodium peroxide in a nickel crucible over an alcohol flame according to the method of the Association of Official Agricultural Chemists.[12] From the acidified solution of the fusion product sulphur was precipitated in the usual manner. Very interesting data were obtained in that the sulphur content of all six samples, three of them of plant origin and three of animal origin, is practically a constant.

Since the sulphur content was constant for these test catches, two others of the larger series which had been collected previously were examined. Catch number 112 was taken August 4–7, 1913, from Lake Mendota. The vegetable material predominates over the animal matter. Catch number 168 is a plant scum from Lake Mendota collected on July 11, 1914.

The apparent constancy of the sulphur content of the plankton of Lake Mendota will be investigated further and samples collected since the summer of 1911 will be examined.

The content of sulphur is recorded below:

[1] Ann. Chem. Pharm. **111**, 21 (1859).
[2] Med. Centralbl. **13**, 588 (1875).
[3] Abderhalden's Biochem. Handlexikon **2**, 527 (1911).
[4] Z. physiol. Chem. **2**, 213–227 (1878).
[5] Z. Biol. **22**, 480 (1887).
[6] Z. physiol. Chem. **20**, 498–510 (1885).
[7] Comp. rend. **120**, 1000 (1895).
[8] Beiträge Chem. Physiol. u. Pathol. **1**, 524 (1902).
[9] Biochem. Z. **7**, 117–127 (1908).
[10] Monatsch. **29**, 1023–1036 (1908).
[11] Biochem. Z. **38**, 468–491 (1912).
[12] U. S. Dept. Agr. Bur. Chem. Bull. 107, 23 (1912).

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Sample	Total sulphur	Nature of catch
A	0.60%	plant
B	.61	plant
C	.60	animal
D	.64	animal
E	.64	plant
154	.63	animal
112	.42	mixed
168	.60	plant

No data on the sulphur content of marine plankton are available.

Total phosphorus. The phosphorus content was determined by the method of the Association of Official Agricultural Chemists with the following modification. The material under examination was treated with an alcoholic solution of magnesium nitrate, evaporated to dryness, and ignited. Silica was removed by the method outlined in a previous paragraph and the phosphorus precipitated in the filtrate as ammonium phosphomolybdate. This precipitate was dissolved in ammonia and the phosphorus precipitated with magnesia mixture, collected on a filter, ignited and weighed as magnesium pyrophosphate.

The range of values is within narrow limits as shown by the following table:

Sample	Total phosphorus
A	1.07%
B	0.91
C	1.22
D	1.41
E	1.40
154	1.57

No results of the phosphorus content of marine plankton have been published.

Nitrogen. Experiments were made to determine the amounts of several forms of nitrogen present.

Protein nitrogen was determined by heating the sample under examination with water, adding a measured volume of moist cupric hydroxide (Stutzer's reagent) and filtering when the solution had cooled. The nitrogen in the washed precipitate

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was then determined by the modified Kjeldahl method used throughout this work. Non-protein or "amide" nitrogen was obtained by subtracting the value found from the total nitrogen.

Two catches which have not been included in the preceding determinations were also examined at this point. The percentages of protein and non-protein nitrogen are recorded below.

Sample	Total nitrogen	Protein nitrogen	Non-protein nitrogen	Protein (N x 6.25)
A	6.15%	3.93%	2.22%	24.56%
B	5.58	4.62	0.96	28.87
C	8.25	3.83	4.42	23.94
D	8.55	3.50	5.05	21.87
E	9.94	8.67	1.27	54.18
154	8.85	4.47	4.38	27.94
5138	4.51	2.82	1.69	17.62

The following forms of nitrogen were determined by the method of Hausmann[1]: nitrogen as ammonia, "humic" nitrogen, and nitrogen in the mono-amino and di-amino acids. The sample was boiled with constant-boiling hydrochloric acid until it no longer reacted with the biuret test. Hydrolysis completed, the ammonia formed was distilled off with magnesia cream. The "humic" nitrogen was determined in the magnesium oxide precipitate. Di-amino nitrogen was then precipitated from the filtrate with an acid solution of phosphotungstic acid and the mono-amino nitrogen determined in the filtrate from the preceding. The latter form predominates in all the catches examined. The quantity of material available for this work has not made it possible to attempt a further differentiation of the proteins.

A tabulation of the results follow:

Sample	Total nitrogen	Nitrogen as NH_3	Di-amino nitrogen	Mono-amino nitrogen	"Humic" nitrogen
A	6.15%	0.70%	1.22%	3.69%	0.56%
B	5.58	.70	.96	3.55	.38
C	8.25	.97	1.90	4.77	.50
D	8.55	.76	2.14	5.16	.38
E	9.94	1.09	2.79	5.39[2]	.67

[1] Z. physiol. Chem. 27, 95 (1899).

[2] Obtained by difference.

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The residues obtained in quantitatively extracting five of the catches in this series with 95 per cent purified alcohol were found to be nitrogen-containing. The extracts were evaporated under diminished pressure and then dried over sulphuric acid. A quantitative extraction of the Daphnia catch was not made at this time, but the alcoholic extract obtained in an attempt at the isolation of chitin was evaporated to dryness as above examined for nitrogen. The residues from the plant catches were of a gummy consistency. Their nature was such as to preclude grinding preparatory to taking a representative sample and hence the nitrogen was not determined. Inasmuch as the crustacea catches contain approximately the same amount of alcohol-soluble matter, the latter was mixed and the nitrogen content of the mixture determined. Analyses show that practically all of the nitrogen entering into the alcohol extract is water-soluble. The remainder is considered as "coagulable nitrogen" and proteose nitrogen.

The results obtained are recorded below.

Sample	Alcohol extract	Total nitrogen	Water-soluble nitrogen
A	28.65%		
B	20.71		
C	54.10	9.69%	9.38%
D	53.83		
E	26.97		
154		10.32	10.55

Carbohydrates. Various hexose and pentose sugars have been reported in the marine algae. Konig and Bettles[1] found d-galactose, levulose and d-glucose. Muther and Tollens[2] found d-galactose, small quantities of arabinose and fucose. Kylin[3] found traces of dextrose and trehalose. Brandt[4] identified none of the carbohydrates in the plankton of the Bay of Kiel although he reports their presence. He made an elementary analysis, calculated the carbon and hydrogen to protein and fat, and the remainder to carbohydrate. Hoagland[5] studying the organic constituents of the Pacific coast kelps re-

[1] Loc. cit.
[2] Ber. 37, 298–305 (1904).
[3] Z. physiol. Chem. 94, 337–425 (1905).
[4] Loc. cit.
[5] Jr. Agr. Research 4, 337–425 (1915).

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ports the absence of reducing sugars. He was able, however, to isolate a complex carbohydrate constituent of the pentosan type which he called algin. The latter had been previously reported by Stanford[1].

The following experiments are recorded although they are only a preliminary survey in this direction. In several instances qualitative tests were obtained but the reaction seemed to indicate only traces of carbohydrates present. In view of the small amount of material available for examination, a detailed study of the carbohydrates of the fresh water plankton was not undertaken at this time. However, our findings are reported here in the hope that they may be a guide to some future study when a favorable opportunity presents itself for obtaining a larger catch of these small organisms. It should be stated in this connection that all the investigators of marine algae worked with kilograms of the material, whereas we were limited to several hundred grams for the entire study.

Six plankton catches were examined. The crustacea plankton were first extracted with water, followed by 95 per cent, 70 per cent and 50 per cent alcohol respectively. The aqueous or de-alcoholized extract, as the case might be, was treated with basic lead acetate solution, the precipitated matter removed, and the excess of lead precipitated as the sulphate. The filtrate did not reduce Fehling's solution either before or after inversion. This indicates the absence of reducing sugars.

Following the method of the Association of Official Agricultural Chemists, a weighed portion of each crustacea catch was distilled with hydrochloric acid. A small quantity of furfural was formed. It was precipitated with phloroglucinol solution and the resulting phloroglucid calculated to pentosans.

Extracts of the plant catches "A" and "B" made with 50 per cent alcohol and purified as above showed a slight reducing action upon Fehling's solution. No osazone, however, was obtained with phenylhydrazine in acetic acid solution. A good precipitation of phloroglucid was obtained from the furfural liberated on distilling the samples with hydrochloric acid.

The algal catch "E" and the mixed diatom-crustacea catch 5138 were covered with water in large flasks. The latter were placed in a boiling water-bath for one hour and then set aside

[1] Chem. News 47, 254–257 (1883).

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for twelve hours. After the subsidence of the suspended matter, the supernatant liquid was filtered through filter paper pulp and the operation repeated. The united filtrates were treated with lead subacetate solution and the excess of lead removed from the filtrate with hydrogen sulphide. The lead-free filtrates were evaporated under diminished pressure to a small volume. A faint, though positive, reaction was obtained with Molisch's alpha-naphthol reagent, but no reaction with orcinol solution or orcinol and ferric chloride solution. No pentoses are present, yet there are indications of the presence of other carbohydrates for the solution showed a slight reducing action toward Fehling's solution.

The extract from catch 5138 gave with phenylhydrazine hydrochloride and sodium acetate an amorphous brown precipitate. A microscopic examination of the latter showed that it contained brownish-yellow needles. By the cautious addition of a little water, enough were removed for a melting point determination. They charred at 215° C. but did not melt. We concluded that they were not crystals of an osazone. The small quantity of crystals obtained did not permit of an examination as to their identity.

The amorphous precipitate was washed with cold water to remove the excess of reagents mechanically held. A part was then dissolved in hot alcohol and another part in purified pyridine. Ethyl ether was stratified over one portion of the pyridine solution and benzol over the other. From neither the alcoholic nor the pyridine solutions was a crystalline product obtained which would indicate that the precipitate was, or contained an osazone. Further attempts at the isolation of an osazone had to be abandoned on account of a lack of material. A smaller amount of furfural was obtained from this catch than from the other plant catches. This was to be expected, however, on account of the presence of the crustacea in the sample.

Five grams of catch 5138 were treated for one hour on a boiling water-bath with 150 cc. of 50 per cent purified neutral alcohol in a 200–cc. flask. The flask was then set aside over night. The solution was made up to the mark with 95 per cent alcohol and filtered. An aliquot was dealcoholized and washed into a 100–cc. flask, basic lead acetate solution was added and volume made up to the mark with water. It was then filtered and the lead removed from the filtrate with

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anhydrous sodium sulphate. Twenty-five cc. of the filtrate yielded an amount of cupric oxide by the Defren-O'Sullivan method equivalent to 29.3 mg. dextrose. The amount of reducing sugar found when calculated as dextrose is 3.12%. The solution was hydrolyzed by letting it stand over night with 5 cc. of concentrated hydrochloric acid. No change in reducing power was found under these conditions. This indicates the absence of a disaccharide or a glucoside.

The colloidal nature of the extract obtained from the algal catch "E" under similar conditions precluded a quantitative determination of reducing sugars. A good reaction was obtained, however, with Molisch's reagent.

The work of Hoagland[1] and of Stanford[2] on the algin of marine kelps lent interest to the isolation of a similar carbohydrate constituent from our fresh water plankton. Five grams of material were digested cold for 24 hours with a two per cent solution of sodium carbonate. The supernatant liquid was decanted and the residue thoroughly washed with cold water. From the combined filtrate and washings dilute hydrochloric acid caused no precipitation. This indicates the absence of a substance comparable to their algin.

The furfural obtained on distillation with hydrochloric acid of specific gravity 1.06 when calculated to pentosans was as follows:

Sample	Pentosans
A	2.67%
B	3.00
C	1.30
D	1.14
E	3.42
154	0.78
5188	2.30[3]

Inasmuch as the plankton catches alluded to in the introduction of this paper are rarely pure, being for the most part mixtures of vegetable and animal forms, it seemed desirable to find some chemical method whereby the composition of a plankton catch may be determined with a fair degree of certainty

[1] Loc. cit.
[2] Loc. cit.
[3] Analysis by G. M. Bishop of the Survey.

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and accuracy. Although the organisms in each catch are counted under the microscope per unit volume, a check by chemical means is often desirable.

The alleged absence of pentosans in the animal kingdom suggested the possibility of adapting the results of the pentosan determination of a plankton catch to an estimation of the proportion of vegetable life in a mixture of animal and vegetable forms. In order to do this, it is necessary to examine a number of pure representative vegetable samples for the purpose of establishing an average figure on the yield of furfural obtained under the conditions of the determination. Likewise it is necessary to obtain an average figure for pure animal forms of the kind met with in a survey of this kind.

The pentosan content of seven catches of the larger series which were known to be nearly pure crustacea was determined. The quantity of pentosan-reacting material obtained and which was weighed as phloroglucid ranged from 0.67 to 1.32 per cent, or an average of 0.82 per cent of the dry weight. It was not of the same appearance, nor did it seem to have the same texture, as the phloroglucid obtained from the vegetable samples examined. The average content of several nearly pure algal catches was found to be 1.40 per cent. Various mixtures of these catches were made and the pentosan content of the mixture determined. The values found in twelve mixtures all lay within a narrow range—0.65 to 1.35 per cent. The difference in the average values found is apparently not great enough to cause an appreciable difference in the mixtures examined.

The following data are added to show the futility of trying to make a practical application of this determination.

Algae	Crustacea	Pentosan obtained
1 part	1 part	1.12%
2 "	1 "	1.12
3 "	1 "	1.25
4 "	1 "	1.26
1 "	2 "	1.23
1 "	3 "	0.99
1 "	4 "	0.65
5 "	1 "	1.35
5 "	3 "	1.01
7 "	1 "	1.20
3 "	5 "	0.96

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After this series of experiments had been completed we found that Kröber and Rimbach[1] had successfully applied the pentosan determination to a mathematical formula for determining the percentage composition of paper made from a mixture of rag stock and wood pulp. They established an average value of 12 per cent pentosans in wood pulp and an average value of 1 per cent pentosans in the cellulose of rags, etc. The large difference in values which they obtained with their material as compared with that obtained by us from the plankton samples is to be noted.

Chitin. The shells of the plankton crustacea contain chitin. Gibson[2] showed that it sometimes replaces cellulose in plants. Winterstein has isolated it from certain fungi[3], as Boletus edulis, Polyporus officinalis, Agaricus compestris and others. Wester[4] obtained it from the shell of the shrimp, from cantharis, champignon, ergot, the cuttlefish and from crabs' eyes. Hegler[5] and Kohl[6] report having found chitin in the walls of many blue-green algae but Wester was unable to confirm their results.

With modifications to adapt it to our needs, we tried Winterstein's scheme of separation and isolation. The fat-free sample was boiled under a reflux condenser with three successive portions of 95 per cent alcohol, washed by decantation, and the filtrate and washings evaporated under reduced pressure to dryness. This residue was examined as above described for nitrogen. Extraction by 60 per cent alcohol followed and the residue was washed with cold water until colorless. The filtrate was practically colorless which showed that the extraction with the strong alcohol is quantitative. Proteins were then decomposed by treating the residue with 300 cc. of a one per cent sodium hydroxide solution. The solution was left standing in the cold for sixteen hours and was then boiled for thirty minutes. This digestion, after the alkali and the decomposition products had been washed out, was followed by a digestion in the cold for twenty-four hours with 200 cc. of 0.1 normal hydrochloric acid and then by digesting on the water-bath for four hours. The residue so obtained was washed with boiling water.

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[1] Z. angew. Chem. **25**, 510 (1902).
[2] Ber. **28**, 821 (1895).
[3] Z. physiol. Chem. **19**, 521–630 (1894).
[4] Arch. d. Pharm. **247**, 282–307 (1909).
[5] Jahrb. Wiss. Bot., **36**, 279 (1901).
[6] Ueber d. Organ. und Physiol. Cyanophyceenzelle, Jena, 1903.

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The residues were then washed from the filters with 100 cc. of ten per cent hydrochloric acid, the acid saturated with potassium chlorate crystals, and the beakers allowed to stand for twenty-five days. Within twenty-four hours the residues had turned white. At the end of this period the solutions were diluted to about 700 cc. with distilled water, the contents of the beakers filtered, and thoroughly washed. To remove the last traces of chlorine and hydrochloric acid, the residues were macerated for twenty-four hours with 500 cc. of 0.05 normal ammonium hydroxide. The residues had lost their original texture and filtered very slowly. An operation that ordinarily required thirty minutes at the most now took a week though filtered at the suction pump. The residues were collected on tared filter papers, washed with boiling water, and then with alcohol and ether. They were finally dried at the temperature of boiling water.

The residues were hard and brittle. They contained no sulphur or phosphorus and it did not respond to the biuret or to the xanthoproteic reactions. This indicated the absence of a protein. Chitin was identified in these residues by Zander's test[1]. This test depends upon the brown coloration obtained when chitin-containing substances are treated with a drop of a strong potassium iodide solution and then a concentrated zinc chloride solution.

As in the case of the crude fiber, these residues were found to contain nitrogen and in fact in the proportion in which nitrogen has been reported in chitin by various investigators. While the values obtained were within the range of nitrogen reported by others, still the method leaves much to be desired both as to convenience and rapidity and because of the difficulty of obtaining a perfectly pure product. We believe that this form of nitrogen can be most expeditiously determined in the crude fiber.

The crustacea plankton only were examined for chitin. The extracts obtained in the initial stages of the analysis of catch "E" were of such a slimy character that they were attacked by a mold before they had finally passed through the filter, and hence were discarded. The results follow:

[1] Pfluger's Archiv **66**, 545.

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Sample	Residue	Nitrogen in the residue
A	4.41%	5.91%
B	4.45	5.64
154	3.25	6.21

Summary

In the examination of seven typical plankton catches made preliminary to and in part concomitant with an extensive chemical survey of the plankton of Lakes Mendota and Monona, it was found that from 40 to 87 per cent of the total nitrogen was present in an available form, that is as protein nitrogen. The remainder was non-protein nitrogen which included, among other forms, that nitrogen entering into the indigestible chitin molecule. The latter was present in larger amounts in those catches which contain a preponderance of animal matter (crustacea) than in those catches which consist almost entirely of vegetable matter. Chitin was isolated from the crustacea plankton in which it is present to the extent of 5.9 to 6.2 per cent of the dry weight.

Nitrogen of the mono-amino acids was the predominant form among the hydrolysis products with hydrochloric acid of both the plant and crustacea catches. Amide-nitrogen, di-amino nitrogen and "humic" nitrogen made up the rest. The nitrogenous constituents of the alcoholic extracts of the crustacea catches were almost all water-soluble.

The sulphur content of all the catches examined in this connection and that of two other catches selected at random from the larger series of the survey showed a surprising constancy. This constancy was not shared, however, to such a marked degree by the phosphorus.

An investigation as to the nature of the carbohydrates present was perforce only a preliminary survey in this direction. Qualitative tests indicated the presence of only small quantities of sugars. The amounts detected made it apparent that a larger quantity of material would be necessary for a thorough study than was available with present means of collecting.

The crustacea catches did not show the presence of any reducing sugars either in the aqueous extract or the extracts with 95 per cent, 70 per cent, or 50 per cent alcohol. Those catches in which plant matter predominates to such an extent

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that the animal matter present can be neglected showed the presence of reducing sugars soluble in 50 per cent alcohol. A catch of blue-green algae and a mixture of diatoms and crustacea were found to contain carbohydrates soluble in hot water. No pentoses were present although a qualitative test with Fehling's solution indicated the presence of some reducing sugars. An amorphous precipitate obtained in the purified and concentrated aqueous extract of the diatom-crustacea catch with phenylhydrazine hydrochloride and sodium acetate did not show the presence of an osazone soluble in hot 60 per cent alcohol or in pyridine. A quantitative determination of the reducing power of this extract with Fehling's solution both before and after hydrolysis with hydrochloric acid proved the absence of disaccharides or glucosides.

No substance soluble in dilute sodium carbonate solution and comparable to the algin reported in marine algae is present in the catches examined.

All the samples examined yielded measurable amounts of furfural which was collected as the phloroglucid and calculated to pentosan. It was found that the difference in the average yield of furfural obtained from a number of relatively pure vegetable catches and animal catches was not sufficiently great to warrant applying the determination of pentosans as a chemical means of estimating the proportion of vegetable life in mixtures of animal and vegetable forms.

The ether extracts of the crustacea catches were found to be oils. The physical and chemical constants obtained indicate that they should be classed with the fish oils. The quantity and the physical nature of the extracts obtained from the vegetable catches did not permit of similar determinations.

Note: The author wishes to extend his thanks to Dr. E. A. Birge, Dean of the College of Letters and Science of the University of Wisconsin and Director of the Wisconsin Geological and Natural History Survey, for suggesting and making possible the study of the problem outlined above. Thanks are also due to Mr. Chancy Juday of the Survey staff for collecting the material used in this study and his interest in the work. To Prof. Richard Fischer he is also indebted for his timely help and suggestions.

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A SECOND LIST OF ALGAE FOUND IN WISCONSIN LAKES

GILBERT MORGAN SMITH

Notes from the laboratory of the Wisconsin Geological and Natural History Survey XIV.

The following list of algae is a continuation of the study of Wisconsin algae under the auspices of the Wisconsin Geological and Natural History Survey. The collections of the past season (1916) are from two lake areas that were not visited before; the Southeastern part of the state in Walworth, Kenosha and Racine counties, and the Northwestern in Sawyer, Washburn, Barron, Rusk and Polk counties. The scope of the work has been curtailed since the publication of the first list and attention has been confined to the phytoplankton.

Following the system used in the preliminary list, the exact location of each new lake is given in the following table.

In citing the geographical distribution of the lakes they are placed in three groups as follows: I, those mentioned in the preliminary list; II, the Southeastern lake area; III, the Northwestern lake area. In order to show the relative abundance of each individual species the following symbols are used; (aaa) very abundant, (aa) abundant, (a) fairly abundant, (ccc) very common, (cc) common, (c) fairly common, (s) fairly scarce, (ss) scarce, (sss) very scarce, (r) fairly rare, (rr) rare, (rrr) very rare.

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Lake	County	Town	Range	Section
Amicoy	Rusk	34N	8W	25
Bear	Barron, Washburn.	36N	12W	1, 2, 3
Beaver	Waukesha	8N	18E	
Beaverdam	Barron	36N	13 & 14W	
Birch	Washburn	37N	10W	24
Brown's	Racine	1 & 2N	19E	
Camp	Kenosha	1N	20E	
Center	Kenosha	1N	20E	
Chetac	Sawyer	37, 38N	9W	3, 17, 4, 34, 33
Chetek	Barron	33N	10W	29
Delavan	Walworth	2N	16E	
Devils	Barron	36N	11W	5, 6, 7, 8
Duck	Barron	36N	13W	32, 33
Dummy	Barron	36N	13W	28
Eagle	Racine	3N	20E	
Elizabeth	Kenosha	1N	19E	
Granite	Barron	36N	13W	20, 29
Green	Walworth	4N	16E	
Grindstone	Sawyer	40N	8, 9W	
Hooker	Kenosha	1N	20E	
Horseshoe	Polk	34N	15W	1, 12, 13
Island	Rusk	33N	8W	28, 29
Lac Court Oreilles	Sawyer	39, 40N	8, 9W	
Lauderdale (see Mill, Middle and Green Lakes)				
Little Rice	Rusk	33N	8W	23, 26
Mary	Kenosha	1N	19E	
Middle	Walworth	4N	16E	
Mill	Walworth	4N	16E	
Owen	Bayfield	44N	7W	
Number One	Sawyer	37N	9W	
Paddock	Kenosha	1N	20E	
Pine	Waukesha	8N	18E	
Pokegama	Barron	33N	10W	17, 20
Prairie	Barron	33, 34N	11W	2, 12, 13, 19
Reserve	Sawyer	39N	8W	5, 8
Rice	Barron	35N	11W	16, 21
Shell	Washburn	37, 38N	12, 13W	
Silver	Barron	36N	13W	14, 25
Silver	Kenosha	1N	20E	
Twin Lakes (See Mary and Elizabeth)				
Vermilion	Barron	35N	13W	14, 15
Whitefish	Sawyer	39N	9W	12, 14

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Class **PHAEOPHYCEAE**

Order **Chromulinales**

Family EUCHROMULINACEAE
Genus CHRYSAMOEBA Klebs 1893.

CHRYSAMOEBA RADIANS Klebs.

Zeits. f. wiss. Zool. 55: 407, *pl.* 18, *figs.* 1a–1c. 1893.
I. Taylor (rr).

Family MALLOMONADACEAE
Genus MALLOMONAS Perty 1852

MALLOMONAS TONSURATA Teiling

Sv. Bot. Tids 6: 277. *fig.* 3. 1912
I. Waupaca (rr).

MALLOMONAS PRODUCTA (Zach.) Iwanoff.

Bull. de l'Acad. d. Sc. d. St. Pétersbourg, 5 Ser. 11: 250. *figs.* A^4 A^6. 1899.
I. Catfish (sss), Cranberry (ss).

var. MARCHICA Lemmermann.

Zeits. f. Fischeri. 106 1903.
I. Oconomowoc (ss), Tamarack (sss).

MALLOMONAS CAUDATA Iwanoff.

Bull. de. l'Acad. d. Sc. d. St. Pétersbourg, 5 Ser. 11: 250. *figs.* B^1-B^6. 1899.
I. Birch (rrr), Hill (ss), No Mans (ss), Rock (cc), North Turtle (r).

Genus CHRYSOSPHAERELLA Lauterborn 1896.

CHRYSOSPHAERELLA LONGISPINA Lauterborn.

Zeits. f. wiss. Zool. 65: 381. *pl.* 18, *figs.* 12–16. 1899; Zool. Anz. 19: 16. 1896.
I. Lac la Belle (ccc), Oconomowoc (ss), Okauchee (r), Waupaca (sss).
II. Elizabeth (rr), Mary (ss), Silver (ss).

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Order **Isochrysidales**

Family EUHYMENOMONADACEAE
Genus SYNURA Ehrenberg 1838.

SYNURA UVELLA Ehrenberg.

Die Infusionsthierchen. 60. *pl.* 3, *fig.* 9. 1838.
I. Mendota (ss), Oconomowoc (ss), North Turtle (rr), Waupaca (r).
II. Camp (ss), Mill (cc).

Order **Ochromonadales**

Family EUCHROMONADACEAE
Genus UROGLENOPSIS Lemmermann 1899.

UROGLENOPSIS AMERICANA (Calkins) Lemm.

Forschungsbr. a. d. Biol. Stat. zu Plön 7: 107. 1899; Kryptogamenfl. d. M. Brandenburg 3: Algen 1: 449. 444 *figs.* 1–6. 1908
I. Mendota (ss), Oconomowoc (rr), Okauchee (sss).
II. Browns (ss), Camp (ss), Eagle (sss), Mill (ss), Paddock (s).

Genus DINOBRYON Ehrenberg 1833

DINOBRYON CALICIFORMIS Bachmann.

Arch. f. Hydrobiol u. Planktonkde 3: 82. *fig.* XI [12]. 1908.
II. Browns (sss) (On *Microcystis)*

DINOBRYON SETULARIA Ehrenberg.

Die Infusionsthierchen. 124. *pl.* 8, *fig.* 8. 1838.
I. Devils (ccc), Lost (ss), Lower Nehmabin (r), Rock (cc).

DINOBRYON SOCIALE Ehrenberg.

Die Infusionsthierchen. 125. *pl.* 8. *fig.* 9. 1838.
I. Green (sss), Oconomowoc (cc), North Turtle (rr), Waupaca (cc), Trout (rr)
II. Green (ss), Mill (ccc), Silver (s).

DINOBRYON STIPITATUM, Stein.

D. Org. d. Inf. 3: 1. *pl.* 12, *f.* 5. Lemmerman Flagellata 2, in Pascher, D. Süsswasserfl. Deut., Österr. u. d. Schw. 2: 73. *f.* 118. 1913.
I. Oconomowoc (ss), Waupaca (ss).

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Dinobryon bavaricum Imhof.

Zool. Anz. 13. 484 1890; Lemmermann, Bot. Not. 1903; 78. *pl.* 3, *figs.* 3–4.

I. George (sss), Harris (rr), Oconomowoc (rr), Speese (ss), Waupaca (ss).

Dinobryon divergens (Imhof) Lemmermann.

Ber. d. D. Bot. Ges. 18: 517. *pl.* 19, *figs.* 15–20. 1900.

I. George (r), Green (rr), Hill (cc), Lac la Belle (ss), Meta (r), Oconomowoc (cc), Rock (ss), Speese (cc), Tamarack (ss), Turtle, North (ss), Waupaca (s).

II. Browns (cc), Center (ss), Elizabeth (cc), Mary (c), Mill (cc), Silver (cc).

Family PHAEOCAPSACEAE.
Genus PHAEOCOCCUS Borzi 1892.

Phaeococcus planctonicus W. & G. S. West.

Trans. Roy Soc. Edinb. 41: 496. *pl.* 6, *figs.* 15–16. 1905.

The margins of the chromoplasts of the Wisconsin form are entire and not irregularly lobed as the Wests describe them.

I. Devils (cc), Mendota (sss).

II. Mary (s), Silver (s).

III. Shell (sss).

Class **MYXOPHYCEAE.**

Order **Chroococcales.**

Family CHROOCOCCACEAE.
Genus CHROOCOCCUS Nägeli 1849.

Chroococcus dispersus (v. Keissler) Lemmermann.

Arkiv. f. Botanik 2: *No.* 2: 102. 1904.

C. minor var. *dispersus* v. Keissler, Verh. d. zool.-bot. Ges. in Wien 52: 311. *fig.* 6. 1902.

II. Browns (rr).

Chroococcus limneticus Lemmermann.

Bot. Cent. 76: 153. 1898: Forschungsbr. a. d. Biol. Stat. zu Plön 7: 132. *pl.* 1, *figs.* 22–23. 1899.

I. Beaver (Oconomowoc) (rr), Upper Nashotah (rr).

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II. Browns (sss), Camp (rr), Eagle (rr), Mary (rr), Mill (rr), Silver (r).
III. Birch (ss), Chetac (r), Chetek (rrr), Grindstone (rr), Horseshoe (r), Island (rr), Lac Court Oreilles (rr), Pokegema (rr), Reserve (sss).

var. DISTANS G. M. Smith.

Bull. Torr. Bot. Cl. 43: 481. *pl.* 26, *f.* 26. 1916.
II. Browns (sss).

var. SUBSALSUS Lemmermann.

Forschungsbr. a. d. Biol. Stat. zu Plön 8: 84. 1901; Arkiv f. Botanik 2: *No.* 2. 101. *pl.*, 1, *f.* 9. 1904.
III. Lac Court Oreilles (ss), Owen (ss).

var. **elegans** var. nov

Colonies of 8–64 cells in a copious, hyaline gelatinous envelop. Cell contents olive green, without pseudovacuoles.

Diam. cells (with individual sheath) 20–26, μ; (without sheath) 18–22, μ. Diam. colonies up to 225, μ.

The cells of this variety are shaped like the typical *C. limneticus*, but their size is greater than any other variety.

II. Delavan (rr).

CHROOCOCCUS TURGIDUS (Ktz.) Nägeli.

Gatt. einz. Algen, 46. 1849; G. S. West, Brit. Freshw. Algae 352. *f.* 166b. 1904.
I. Beaver (rr).
II. Browns (rr).

CHROOCOCCUS GIGANTEUS W. West.

Jour. Roy. Micr. Soc. 1892. p. 741. *pl.* 10, *figs.* 59–60.
II. Mary (rrr).

Genus RHABDODERMA Schmidle & Lauterborn 1900

RHABDODERMA LINEARE Schmidle & Lauterborn.

Ber. d. D. bot. Ges. 18: 148. *pl.* 6, *figs.* 8–11. 1900.
III. Whitefish (rr).

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Genus DACTYLOCOCCOPSIS Hansgirg 1892.

DACTYLOCOCCOPSIS ACICULARIS Lemmermann.

Ber. d. D. bot. Ges. **18**: 309. 1900; Kryptogamenfl. d. M. Brandenburg **3**: Algen 1. 51, 44. *f.* 5. 1907.
II. Browns (sss).

The cells of this species that have been observed have a parietal chromatophore. Lemmermann does not state this fact in his original description of the alga, but parietal chromatophores have been described in the genus by G. S. West (Brit. Freshw. Algae p. 348. 1904). The presence of a parietal chromatophore suggests that the alga is possibly a member of the Chlorophyceae but since its color is a pale blue green it should be placed in the Myxophyceae. (Plate **14**, figs. **2–4**).

DACTYLOCOCCOPSIS RAPHIDIOIDES Hansgirg.

Prodr. d. Algenfl. v. Böhmen 139. *f.* 49a. 1892.
III. Reserve (rr), Rice (rr).

Genus APHANOCAPSA Nägeli 1849.

APHANOCAPSA GREVILLEI (Hass.) Rabenhorst

Flora Eur. Algarum **2**: 50. 1865.
Coccochloris Grevillei Hassall, Hist. Brit. Freshw. Algae 318. *pl.* 78, *figs.* 7–8. 1845.
II. Camp (ss).
III. Beaverdam (rr), Birch (ss), Chetac (sss), Rice (ss), Whitefish (ss).

APHANOCAPSA PULCHRA (Ktz.) Rabenhorst.

Flora Eur. Algarum **2**: 49. 1865.
III. Beaverdam (sss), Lac Court Oreilles (ss).

APHANOCAPSA ELACHISTA var. CONFERTA W. & G. S. West.

Jour. Linn. Soc. Bot. **40**: 432. *pl.* 19, *f.* 1. 1912.
II. Silver (rr).

Genus APHANOTHECE Nägeli 1849.

APHANOTHECE NIDULANS P. Richter.

Bot. Not. 1884: 128.
I. Beaver (Oconomowoc) (ss).

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APHANOTHECE NIDULANS var. ENDOPHYTICA W. & G. S. West.

Journ. Linn. Soc. Bot. 40: 432. *pl.* 19, *f.* 14. 1912.
III. Chetac (ss), within colonies of *Coelosphaerium Naegelianum* Unger.

APHANOTHECE STAGNINA (Sprengel) A. Br.

In Rabenhorst Algae No. 1572; Kützing, Tab. Phycol. 1: *pl.* 18, *f.* 3.
III, Whitefish (rr).

APHANOTHECE PRASINA A. Br.

In Rabenhorst, Flora Eur. Algarum 2: 65. 1865; Cooke, Brit. Freshw. Algae 218. *pl.* 88, *figs.* 3a–3b. 1882.
III. Beaverdam (r).

Genus MICROCYSTIS Kützing 1833.

MICROCYSTIS FLOS-AQUAE (Wittr.) Kirchner.

In Engler & Prantl. nat. Pflanzenfam. 1: Abt. 1a: 56. *fig.* 49N 1898.
II. Browns (cc), Center (cc), Paddock (ss.)
III. Duck (ss), Horseshoe (rr), Shell (rr), Whitefish (ss).

MICROCYSTIS AERUGINOSA Kützing.

Tabulae Phycol. 1: 6. *pl.* 8. 1849.
II. Browns (cc), Delavan (sss), Elizabeth (cc), Hooker (ss), Mill (sss), Silver (ss).
III. Bear (rr), Devils (rr), Grindstone (rr), Owen (rrr), Pokegema (ss), Prairie (sss), Rice (ss).

var. MAJOR (Wittr.) G. M. Smith.

Trans. Wis. Acad. Sci. Arts. & Lett. 18[2]: 535. 1916.
II. Center (rr).
III. Vermilion (ccc).

MICROCYSTIS INCERTA Lemmermann.

Abh. Naturw. Ver. Bremen 17: 342. 1903; Ber. d. D. bot. Ges. 19: 93. *pl.* 4, *fig.* 8 1901. *(as Polycystis incerta).*
II. Camp (rr), Hooker (s).
III. Chetek (rr), Prairie (r), Whitefish (rr).

MICROCYSTIS PULVEREA (Wood) Migula.

In Thomé, Flora v. Deut., Deutsch-Österr. u. d. Schw. 6: 36. 1907.
II. Browns (ss), Mill (rrr).

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Genus COELOSPHAERIUM Nägeli 1849.

COELOSPHAERIUM KUETZINGIANUM Nägeli.

Gatt. einz. Algen 54: *pl.* 1, *f.* C. 1849.

II. Browns (rr), Eagle (ss), Elizabeth (s), Green (rr), Hooker (rr), Mary (s), Mill (rrr), Paddock (ss), Silver (rr).

III. Bear (r), Beaverdam (ss), Grindstone (rr), Horseshoe (rrr), Island (ss), Little Rice (ss), Owen (rrr), Pokegema (rrr), Reserve (ss), Rice (rr), Whitefish (s).

COELOSPHAERIUM NAEGELIANUM Unger.

Mitth. d. Naturw. Ver. f. Steiermark 2: h. 1: *pl.* 2; Borge, Bot. Not. 1900: 10. *pl.* 1, *f.* 5.

II. Browns (rr), Camp (ccc), Center (a), Elizabeth (r), Hooker (rr), Mill (rr), Paddock (ccc), Silver (ccc).

III. Amicoy (ss), Bear (s), Beaverdam (ccc), Birch (aa), Chetac (aa), Devils (ss), Duck (ss), Dummy (rrr), Granite (ss), Grindstone (ss), Horseshoe (ss), Island (cc), Littlerice (cc), Number One (ss), Pokegema (s), Prairie (ss), Rice (cc), Whitefish (ccc).

Genus GOMPHOSPHAERIA Kützing 1836.

GOMPHOSPHAERIA APONINA Kützing.

Decades 16: No. 151. 1836; Tabulae Phycol. 1: 22. *pl.* 31, *f.* 3. 1849.

I. Pine (rr).

II. Browns (rr), Center (rr), Eagle (rr), Elizabeth (rr), Mary (rr), Silver (rr).

var. CORDIFORMIS Wolle.

Bull. Torr. Bot. Cl. 9: 25. *pl.* 13, *f.* 11. 1882.

III. Beaverdam (sss).

GOMPHOSPHAERIA LACUSTRIS Chodat.

Bull. Herb. Boiss. 6: 180. *f.* 1. 1898; W. & G. S. West, Trans. R. Irish Ac. 33: sec. B [3]: 112. *pl.* 11, *figs.* 24–27. 1906.

I. Mendota (s).

III. Beaverdam (c).

Genus MERISMOPEDIA Meyen 1828.

MERISMOPEDIA TENUISSIMA Lemmermann.

Bot. Cent. 76: 154. 1898; Forschungsbr. a. d. Biol. Stat. zu Plön 7: 132. *pl.* 1, *f.* 21. 1899.

II. Camp (rr), Mary (rr).

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MERISMOPEDIA GLAUCA (Ehr.) Nägeli.

Gatt. einz. Algen 55. *pl.* 1, *f.* D [1]. 1849.
II. Mill (rr).
III. Lac Court Oreilles (rrr).

MERISMOPEDIA ELEGANS A. Br.

In Kützing, Species Algarum 472. 1849; G. S. West, Brit. Freshw. Algae 348. *f.* 162. C. 1904.
II. Center (rr).
III. Beaverdam (r).

Order **Hormogoneales.**

Family OSCILLATORIACEAE

Genus LYNGBYA C. A. Agardh 1824.

LYNGBYA BIRGEI G. M. Smith.

Bull. Torr. Bot. Cl. 43: 482. *pl.* 26, *f.* 28. 1916.
II. Elizabeth (ss), Mary (ss).

Genus TRICHODESMIUM Ehrenberg 1830.

TRICHODESMIUM LACUSTRE Klebahn.

Forschungsbr. a. d. Biol. Stat. zu Plön 3: 13. 1895; Flora 80: 271. *pl.* 4, *figs.* 31–33. 1895.

The general manner of growth of this alga suggests *Aphanizomenon,* but a careful search has failed to demonstrate the presence of heterocysts. It differs from sterile specimens of *Aphanizomenon* in the shorter and relatively broader cells. (Plate **14**, fig. **5**).

III. Island (r), Rice (rr).

Family NOSTOCACEAE

Genus ANABAENA Bory de St. Vincent 1823.

ANABAENA PLANCTONICA Brunnthaler.

Sitzbr. d. Kais. Ak. d. Wiss. Wien. 112 [1]: 292. 1903.
II. Center (cc).

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ANABAENA MACROSPORA var. ROBUSTA Lemmermann.

Bot. Cent. 76: 154. 1898.
II. Camp (ccc).

ANABAENA AUGSTUMALIS var. MARCHICA Lemmermann.

Forschungsbr. a. d. biol. Stat. zu Plön 12: 147. 1905.
II. Center (cc).

ANABAENA LEMMERMANNI P. Richter.

In Lemmermann, Forschungsbr. a. d. biol. Stat. zu Plön 10: 153. 1903.
III. Reserve (r), Rice (sss).

ANABAENA FLOS-AQUAE (Lyngbye) de Bréb.

Mem. de la soc. Acad. de Falaise 1835: 36.
II. Browns (cc), Camp (ss). Eagle (sss), Green (sss), Hooker (r), Mary (rr), Mill (ss), Paddock (ccc).
III. Lac Court Oreilles (ccc), Shell (rrr).

ANABAENA HASSALLII (Ktz.) Wittrock.

Algae exsicc. Fasc. 21: 56.
II. Center (s).

var. MACROSPORA Wittrock.

Algae exsicc. Fasc. 21: 56.
II. Camp (sss).

ANABAENA SPIROIDES var. CRASSA Lemmermann.

Bot. Cent. 76: 155. 1898; Kryptogamenfl. d. M. Brandenburg 3: Algen 1: 188. 159. *figs* 15–16. 1907.
II. Hooker (ccc).
III. Granite (ccc), Vermilion (c).

Genus APHANIZOMENON Morren 1838.

APHANIZOMENON FLOS-AQUAE (L) Ralfs.

Ann. & Mag. of Nat. Hist. 5: 340. *pl.* 9, *f.* 6. 1850.

II. The alga produced a bloom in Amicoy and the Chetek group of lakes that filled the entire lake. The appearance of

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a bloom of this alga is quite striking since, to the naked eye, the lake appears to be filled with small pieces of macerated grass.

II. Camp (r), Center (rrr), Green (ss), Hooker (cc).

III. Amicoy (aa), Bear (rr), Beaverdam (rr), Birch (ss), Chetac (sss), Chetek (a), Granite (a), Horseshoe (r), Island (ccc), Little Rice (sss), Pokegama (a), Prairie (aa), Reserve (rr), Rice (ss), Shell (rrr), Vermilion (r), Whitefish (rr).

Family RIVULARIACEAE
Genus RIVULARIA (Roth) C. A. Agardh 1824.

RIVULARIA ECHINULATA (Smith) Born. et Flah.

Bull. Soc. Bot. France 31: 77. 1884; P. Richter, Forschungsbr. a. d. biol. Stat. zu Plön 2: 31. figs.1–8. 1894.

III. Bear (rr), Beaverdam (rr), Birch (ss), Chetac (ss), Duck (rr), Dummy (rr), Grindstone (rr), Horseshoe (ss), Island (ss), Lac Court Oreilles (ss), Owen (rr), Reserve (rr), Shell (rr), Whitefish (sss).

Class **CHLOROPHYCEAE.**

Order **Volvocales.**

Family VOLVOCACEAE.
Genus GONIUM Mueller 1773.

GONIUM PECTORALE Mueller.

Vermium terrestrium et fluviatilum etc. 1: 60. 1773.

The mucus projections between the individual cells are more fully developed in the plankton individuals of this species. (Plate 10, figs. 1–2).

III. Beaverdam (rrr), Duck (rr), Island (r), Number One (rr).

Genus PANDORINA Bory de St. Vincent 1824.

PANDORINA MORUM Bory de St. Vincent.

Encyc. meth. Hist. Nat. de Zoophytes 2: 600. 1824; G. S. West, Brit. Freshw. Algae 193. *figs.* 76a–76h. 1904.

II. Camp (rr), Center (cc), Hooker (s).

III. Birch (rr), Chetac (rr), Chetek (sss), Duck (ss), Grindstone (s), Lac Court Oreilles (ss), Little Rice (r), Number One (rr), Pokegama (r), Prairie (r), Reserve (rr), Rice (r), Whitefish (ss).

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Genus EUDORINA Ehrenberg 1832.

EUDORINA ELEGANS Ehrenberg.

Abh. d. Kgl. Ak. d. Wiss. zu Berlin Jahrgang 1831: 78. *pl.* 2, *f.* 10. 1832.
II. Camp (cc), Center (sss), Delavan (sss), Elizabeth (rr), Green (rr), Paddock (r), Silver (ccc).
III. Bear (ss), Beaverdam (sss), Birch (ss), Bryer (rr), Chetac (ss), Duck (s), Grindstone (rrr), Horseshoe (rr), Island (ss), Lac Court Oreilles (rr), Number One (rr), Pokegama (ss), Prairie (ss), Reserve (rr), Rice (ss), Vermilion (rr).

Order **Protococcales**

Family PALMELLACEAE.

Genus SPHAEROCYSTIS Chodat 1897.

SPHAEROCYSTIS SCHROETERI Chodat.

Bull. Herb. Boiss. 5: 119 *pl.* 9, *figs.* 1–12. 1897.
II. Browns (rr), Camp (rr), Center (rr), Eagle (rr), Elizabeth (sss), Green (rr), Hooker (rr), Mary (ss), Mill (sss), Silver (r).
III. Bear (ss), Birch (ss), Chetac (ss), Chetek (cc), Lac Court Oreilles (rr), Number One (cc), Pokegama (ss), Prairie (ss), Rice (ss), Shell (ccc).

Genus GLOEOCYSTOPSIS G. M. Smith.

GLOEOCYSTOPSIS LIMNETICUS G. M. Smith.

Bull. Torr. Bot. Cl. 43: 475. *pl.* 24, *fig.* 12. 1916.

In the few colonies observed the chloroplast was distinctly parietal with a single pyrenoid. The original description states that the chloroplast is diffuse; so should be amended to describe the parietal chloroplast of the younger cells. This same condition has been observed in *Nephrocytium* where the chloroplast is parietal in young cells, but becomes indistinct as the cell grows older.

III. Beaverdam (rrr).

Planktosphaeria n. gen.

Cells spherical, embedded in a copious, non-lamellated, hyaline, gelatinous sheath; at first solitary, later irregularly distributed within the colony. Mature cells with several parietal,

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polygonal chloroplasts, each containing a single pyrenoid. Reproduction by liberation of daughter colonies through breaking down of gelatinous sheath.

Planktosphaeria gelatinosa n. sp.

Characters the same as genus. Diam. cells 25–4.5μ; diam. colon. up to 150 μ (Plate **10**, figs. **8–11**).

The numerous parietal chloroplasts form the distinguishing characteristic of the genus. At first glance this condition might be considered a division stage in the reproduction of a *Sphaerocystis* cell, but I am convinced that it is the normal state of the adult cell. The very young cells have a single parietal bell-shaped chloroplast but as the cell grows the number of chloroplasts increases.

I. Mendota (rr).
II. Browns (rr).

Genus ASTEROCOCCUS Scherffel 1908.

Asterococcus limneticus n. sp.

Colonies spherical, rarely ovoid, of 4, 8, or 16 cells widely separated within a hyaline, unlamellated, gelatinous matrix. Chloroplasts, star shaped, with 4–8 rays coming from a central mass and ending in a disc at the cell wall. Pyrenoid, single, at the center of the rays. (Plate **10**, figs. **3–6**).

Diam. cells 7. 5–23μ; diam. colon. up to 125μ.

The genus *Asterococcus* was described by Scherffel (Ber. d. D. bot. Ges. (26A: 762. 1908.) because *Pleurococcus superbus* Cienk. differs so markedly from other species of that genus. The two distinguishing characteristics of *Asterococcus* are a lamellated gelatinous envelope around the cells, and a single star-shaped chloroplast in which strands ending in discs run from the center of the cell to the periphery. There is but one pyrenoid at the center of the cell. Scherffel's figures for the vegetative cells are not particularly good but Chodat (Bot. Ztg. 53: pl. 5, figs. 6, 9, 19, 21, 1895).has given some very characteristic figures of *A. superbus* (Cienk) Scherffel as stages in the life history of *Eremosphaeria*.

The species that I have described above does not have the

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lamellated gelatinous envelope but the star shaped chloroplast is so characteristic of *Asterococcus* that I believe it belongs in the genus. The cells are also much smaller than those of *A. superbus.*

III. Dummy (rr), Horseshoe (ss), Lac Court Oreilles (ss), Owen (cc), Reserve (r), Shell (cc).

Family DICTYOSPHAERIACEAE
Genus DICTYOSPHAERIUM Nägeli 1849.

DICTYOSPHAERIUM PULCHELLUM Wood.

Smithsonian Cont. to Knowl. 19: No. 241: 84. *pl.* 10, *f.* 4. 1872. *(Botryococcus pulchellus* on plate).

II. Center (r), Eagle (rr), Elizabeth (rrr).

III. Amicoy (ss), Bear (ss), Chetek (ss), Duck (cc), Dummy (sss), Granite (ss), Grindstone (rrr), Horseshoe (ss), Lac Court Oreilles (ss), Little Rice (sss), Owen (rrr), Pokegama (c), Prairie (c), Reserve (rr), Rice (ss), Shell (cc), Vermilion (r), Whitefish (rr).

Genus DIMORPHOCOCCUS A. Br. 1849.

DIMORPHOCOCCUS LUNATUS A. Br.

Alg. unicell. 44. 1855: Rabenhorst, Flora Eur. Algarum 3: 36. 6, *f.* a–c 1868.

I. Pine (rrr).

III. Bear (rr), Beaverdam (rr), Devils (r), Horseshoe (rr), Shell (rrr).

Genus WESTELLA de Wildemann 1897.

WESTELLA BOTRYOIDES (W. West) de Wildemann.

Bull. Herb. Boiss. 5: 532. 1897.

Tetracoccus botryoides W. West, Jour. Roy. Micr. Soc. 1892: 735 *pl.* 10, *figs.* 43–48.

II. Mill (rrr).

III. Horseshoe (rr).

var. **major** var. nov.

Cells 8–13 μ in diam.

The size of the cells in this variety is much larger than that of the typical form. The cells are generally in groups of four and the old mother cell wall that holds them together is inconspicuous.

III. Whitefish (rr).

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Family AUTOSPORACEAE
Genus NEPHROCYTIUM Nägeli 1849.

NEPHROCYTIUM AGARDHIANUM Nägeli.

Gatt. einz. Algen 79. *pl.* 3, *fig.* C. 1849.
II. Camp (rr), Mill (rrr).
III. Bear (rrr).

Genus OOCYSTIS Nägeli 1855.

OOCYSTIS SOLITARIA Wittrock.

Bot. Not. 1879. *p.* 24. Figs. 1–5.
II. Hooker (r.)

var. MAJOR Wille.

Öfvers. Kgl. Sv. Vet.-Ak. Förh. 36: No. 5: 26. 1879.
III. Rice (rr).

OOCYSTIS LACUSTRIS Chodat.

Bull. Herb. Boiss. 5: 296. *pl*: 10, *figs.* 1–7. 1897.
II. Camp (sss), Center (s), Mary (r).
III. Chetek (r), Dummy (rr), Pokegama (r), Prairie (rr), Reserve (rr).

OOCYSTIS PARVA W. & G. S. West.

Jour. of Bot. 36: 335. 1898.
I. Beaver (rr).

OOCYSTIS ELLIPTICA W. West.

Jour. Roy. Micr. Soc. 1892: 736. *pl.* 10, *f.* 56.
II. Amicoy (rr).

var. MINOR W. West.

Jour. Roy. Micr. Soc. 1892: 736; W. & G. S. West, *ibid.* 1894: 14. *pl.* 2, f. 26.
II. Camp (sss).

OOCYSTIS BORGEI Snow.

Bull. U. S. Fish Comm. 1902: 379. *pl.* 2, *figs.* 7 ^{1}–7 ^{6}. 1903.
II. Camp (r), Green (rr).

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OOCYSTIS GLOEOCYSTIFORMIS Borge.

Botaniska Studier tillägnade F. R. Kjellmann 23. *pl.* 1, *f.* 1. 1906.
III. Lac Court Oreilles (sss).

OOCYSTIS NOVAE-SEMLIAE var. MAXIMA W. & G. S. West.

Jour. Roy. Micr. Soc. 1894: 13. *pl.* 2, *f.* 25.
III. Duck (r).

Oocystis eremosphaeria sp. nov.

Cells ovoid, 2–1½ times as long as broad, solitary or in families of 2–4. Chloroplasts numerous, lens shaped, each containing a single pyrenoid. Cell wall thick, with a conspicuous nodule at each pole. (Plates **14**, figs. **8–9**).

Cells 45–35 μ long, 31–23 μ wide. Families up to **100** x60 μ.

The large size of the individual cells together with the numerous chloroplasts at once distinguishes this from all other species. Playfair (Proc. Linn. Soc. N. S. Wales 41: 106–147. 1916) has recently attempted to show that *Eremosphaeria viridis* de Bary is merely a polymorphic condition of *Oocystis* and not a distinct species. The species which is described above is much more like *E. viridis* than any other *Oocystis* species but the cells always have the ovid shape and polar nodule so characteristic of *Oocystis*. There is, in my opinion, no evidence for regarding *E. viridis* as a growth form of Oocystis.

III. Beaverdam (rr), Shell (sss).

Oocystis natans var. **major** var. nov.

Cells 38–31 x 25–16 μ. Families up to 120 x 90 μ. (plate **15**, figs. **6–7**).

This variety has the typical star shaped chloroplast containing a single pyrenoid but the cells are much larger.

III. Birch (sss), Chetac (s).

Genus MICRACTINIUM Fresenius 1858

MICRACTINIUM PUSILLUM Fresenius.

Abh. Senckenb. Naturf. Ges. 2: 236. *pl.* 11, *figs.* 46–49. 1858; G. M. Smith. Bull. Torr. Bot. Cl. 43: 479. *pl.* 25, *f.* 18. 1916.
II. Hooker (rr).
III. Chetek (rr), Island (rrr), Pokegama (rr), Prairie (rr).

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var. **elegans** var. nov.

Cells with 5–7 bristles. (Plate 12, fig. 4).

This new variety is justifiable since the cells of all the colonies in the plankton of this lake possessed 5–7 bristles, whereas cells ordinarily have but 2–4.

III. Rice (rr).

MICRACTINIUM QUADRISETUM (Lemm.) G. M. Smith

Bull. Torr. Bot. Cl. 43: 479. *pl.* 25, *f.* 17. 1916.
II. Camp (rr), Eagle (rrr).

MICRACTINIUM RADIATUM (Chodat) Wille.

In Engler u. Prantl. Nat. Pflanzenfam. 1[a] (Nachtr): 57. 1909.
Golenkinia radiata Chodat, Jour. de Bot. 8: 303. *pl.* 3, *figs.* 1–24 1894.
II. Green (rrr).

MICRACTINIUM PAUCISPINUM (W. & G. S. West) Printz

Kristiana Vidensk. Skr. I. Mat.-Nat. Kl. 1913: No. 6: 55. 1914.
Golenkinia paucispina W. & G. S. West, Trans. R. Irish Ac. 32: sec. B[1]; 68. *pl.* 1, *f.* 18. 1902.
III. Prairie (rr).

Genus TETRAEDRON Kützing 1845.

TETRAEDRON MUTICUM forma PUNCTULATUM (Reinsch) de Toni.

Sylloge algarum 1: 600. 1889.
Polyedrium muticum var. *punctulatum* Reinsch, Notarisia 3: 498. *pl.* 4, *f.* 6. 1888.
III. Beaverdam (rr).

TETRAEDRON MINIMUM (A. Br.) Hansgirg.

Hedwigia 27: 131. 1888; G. S. West, Brit. Freshw. Algae 231. *f.* 101[a]. 1904.
I. Beaver (rr).
II. Camp (rr), Paddock (rrr).

TETRAEDRON CAUDATUM (Corda) Hansgirg.

Hedwigia 27: 131. 1888; G. S. West, Brit. Freshw. Algae 231. *f.* 101[b]. 1904.
III. Reserve (rrr).

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TETRAEDRON TRIGONUM (Nägeli) Hansgirg.

Hedwigia 27: 130. 1888.
III. Rice (rrr).

Tetraedron verrucosum sp. nov.

Cells four-angled, with convex sides, tetrahedric or with the two sides crossed over one another. Angles obtuse, with a thick projection 13–18 μ long. Wall thick, verrucose. (Plate 15, figs. 1–2).

Diam. cells 65–80 μ.

The shape of the cell is at times like *T. regulare* Ktz. but *T. verrucosum* differs in its larger size and verrucose walls. The warts on the walls are more pronounced than in any other species of the genus.

III. Bear (rr).

TETRAEDRON PROTEIFORME (Turner) Brunnthaler.

In Pascher, D. Süsswasserfl. Deutschl., Österr. u. d. Schw. 5: Chlorophyceae 2: 152. *f.* 177. 1915.

Polyedrium proteiforme Turner, Kgl. Sv. Vet.-Ak. Haudl. 25: No. 5: 158. *pl.* 20, *f.* 24B. 1892.

Turner states that the cells may be either two or three-angled, but no two-angled cells were observed in the Wisconsin collections. This species forms a connecting link between the genera *Tetraedron* and *Cerasterias*. (Plate 15, figs. 4–5).

II. Paddock (rrr).
III. Lac Court Oreilles (rr), Rice (rrr).

TETRAEDRON ENORME (Ralfs) Hansgirg.

Hedwigia 27: 132. 1888.

Stăurastrum enorme Ralfs, Brit. Desmidieae 140. *pl.* 33, *figs.* 11a–11e. 1848.

III. Devils (r).

TETRAEDRON LOBULATUM var. POLYFURCATUM G. M. Smith.

Bull. Torr. Bot. Cl. 43: 480, *pl.* 26, *figs.* 21–22. 1916.
III. Beaverdam (rr), Rice (rr), Shell (rrr).

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TETRAEDRON LIMNETICUM Borge.

Bot. Not. 1900: 5. *pl.* 1, *f.* 2.
II. Chetek (r), Island (rr).

TETRAEDRON PLANCTONICUM G. M. Smith.

Bull. Torr. Bot. Cl. 43: 479. *pl.* 26, *figs.* 19–20. 1916.
III. Devils (sss), Granite (rr), Horseshoe (rr), Prairie (rr), Vermilion (r).

TETRAEDRON GRACILE (Reinsch) Hansgirg. (Plate 6, fig. 3).

Hedwigia 28: 19. 1889.
Polyedrium gracile Reinsch, Notarisia 3: 502. *pl.* 7, *f.* 1. 1888.
II. Elizabeth (rr).

Genus POLYEDRIOPSIS Schmidle 1899.

POLYEDRIOPSIS SPINULOSA Schmidle.

Allg. Bot. Zeitschr. 5: 17. 1899.
Tetraedron spinulosum Schmidle, Allg. bot. Zeitschr. 2: 193. *fig.* 2, 1896.

The general tendency among phycologists has been to place this alga in the genus *Tetraedron,* where it was first described, and to consider *Polyedriopsis* unworthy of specific rank. The bristles which are found on the corners of the cells are the same type as those found on *Lagerheimia* and *Micractinium* and, in my opinion, *Poyledriopsis* forms a genus parallel with *Tetraedron* just as *Lagerheimia* does with *Oocystis.* (Plate 12, figs. 2–5).

III. Prairie (rr).

Genus ANKISTRODESMUS Corda 1838.

ANKISTRODESMUS FALCATUS var. ACICULARIS (A. Br.) G. S. West.

Brit. Freshw. Algae 223. *figs* 94B–94C. 1904.
III. Beaverdam (rr), Rice (rr).

ANKISTRODESMUS FALCATUS var. MIRABILIS (W. & G. S. West) G. S. West.

Brit. Freshw. Algae 224. *fig.* 94E. 1904.
III. Bear (rr), Bryer (rr), Devils (rr), Dummy (rr), Horseshoe (rr), Reserve (rr), Whitefish (rr).

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ANKISTRODESMUS LACUSTRIS (Chod.) Ostenfeld. (Plate **11, fig. 1**).

Hedwigia **46**: 384. 1907.
II. Browns (rr).

ANKISTRODESMUS SPIRALE (Turner) Lemmermann.

Arch. f. Hydrobiol. u. Planktonkde. **4**: 176. 1908.
Raphidium spirale Turner, Kgl. Sv. Vet.-Ak. Handl. **25**: No. 5: 156. *pl.* 20. *f.* 26. 1892.
Ankistrodesmus falcatus var. *spiralis* (Turner) G. S. West, Brit. Freshw. Algae 224. 1904.
II. Silver (rrr).

Genus CLOSTERIOPSIS Lemmermann 1898.

CLOSTERIOPSIS LONGISSIMA var. TROPICA W. & G. S. West.

Trans. & Proc. Bot. Soc. Edinb. **23**: [1]: 31. *pl.* 1, *f.* 1. 1905.
Raphidium longissimum var. *tropicum* W. & G. S. West, Trans. Linn. Soc. Bot. 2nd Ser. **6**: 198. 1902.

The dimensions of the Wisconsin material agree with those given in the original description and not with those found in the plankton from Scotland.

I. North Turtle (rr).

Genus SCHROEDERIA Lemmermann 1898.

SCHROEDERIA JUDAYI G. M. Smith.

Bull. Torr. Bot. Cl. **43**: 474. *pl.* 24, *figs.* 9–11. 1916.
II. Camp (rrr).
III. Amicoy (rr), Prairie (rr).

Genus QUADRIGULA Printz 1915.

Quadrigula Pfitzeri (Schröder) n. comb.

Ankistrodesmus Pfitzeri (Schröder) G. S. West, Brit. Freshw. Algae 224. *figs.* 94G–94H. 1904.

Printz has recently founded the genus *Quadrigula* to include those *Ankistrodesmus* species whose cells lie side by side within a common gelatinous envelope. He places *Ankistrodesmus*

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Pfitzeri (Schröder) G. S. West as a synonym of *Quadrigula closterioides* (Bohl.) Printz but since it is an open question whether these two organisms are identical or not the specific name *Pfitzeri* is retained.

III. Beaverdam (rr), Lac Court Oreilles (rr), Reserve (rr), Rice (rr), Shell (rr), Whitefish (rrr).

Genus ELAKTOTHRIX Wille 1898.

ELAKTOTHRIX AMERICANA Wille.

Rhodora 1: 150. 1899.
Fusola viridis Snow, Bull. U. S. Fish Comm. 1902: 389. *pl.* 2, *figs.* VI[1]–VI[4]. 1903.
I. Soft (rr).

Genus SELENASTRUM Reinsch 1867.

SELENASTRUM GRACILE Reinsch.

Die Algenfl. d. mitt. Th. v Franken 65. *pl.* 4, *f.* 3. 1867.
III. Bear (rr), Prairie (rr), Whitefish (rrr).

SELENASTRUM BIBRAIANUM Reinsch.

Die Algenfl. d. mitt. Th. v. Franken 64. *pl.* 4, *f.* 2. 1867.
III. Beaverdam (rr), Rice (rr).

Genus KIRCHNERIELLA Schmidle 1893.

KIRCHNERIELLA LUNARIS (Kirchner) Möbius.

Abh. d. Senckenb. Naturf. Ges. 18: 331. 1894.
II. Elizabeth (rr), Green (rrr), Mill (rr), Paddock (rr).
III. Bear (rr), Beaverdam (rr), Chetek (rr), Devils (rr), Duck (rr), Dummy (sss), Horseshoe (rr), Pokegama (sss), Prairie (sss), Shell (r).

KIRCHNERIELLA OBESA (W. West) Schmidle.

Ber. d. Naturf. Ges. zu Freiburg i. B. 1893: 15 (82). *pl.* 7, *f.* 2. 1893.
II. Camp (rr).
III. Chetac (r), Lac Court Oreilles (ss), Reserve (r), Rice (rr), Whitefish (rrr).

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var. **major** (Bernard) comb. nov.

Kirchneriella major Bernard, Protocc. et Desm. d'eau douce 179. *pl.* 14, *figs.* 398–399. 1908.

The blunt apices and general outline of the cells resembles the typical form, but the space between the apices is much broader and deeper. The resemblance to *K. obesa* is so close, however, that this alga should be placed as a variety and not a distinct species. Schmidle (Flora 78:44 *pl. 7, f.* 3. 1894) has figured a K. *obesa* that is identical with this variety. (Plate **10, fig. 7**).

III. Lac Court Oreilles (r).

KIRCHNERIELLA ELONGATA G. M. Smith.

Bull. Torr. Bot. Cl. 43: 473. *pl.* 24, *f.* 7. 1916.

In the original description of the species I was uncertain whether or not a pyrenoid exists. During the past summer living material was studied with this point in view and none being found, the description should be amended to state that no pyrenoid is present.

III. Devils (rr), Lac Court Oreilles (rr).

Genus ACTINASTRUM Lagerheim 1882.

ACTINASTRUM HANTZSCHI Lagerheim.

Öfvers. Kgl. Vet.-Ak. Förh. 39: No. 2: 70. *pl.* 3, *figs.* 25–26. 1882.

Although the occurrence of this alga was noted in the preliminary list the multiple colonies have only been found in Chetek Lake.

III. Chetek (rr), Prairie (rr).

var. **elongatum** var. nov.

Cells 33–37 x 5–4.5 μ. (Plate **12**, fig. **3**).

The cells of this variety are considerable longer than the typical *A. Hantzschi.*

III. Bear (rr).

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Genus SCENEDESMUS Meyen 1829.

SCENEDESMUS OBLIQUUS (Turp.) Kützing.

Linnaea 8: 609. 1833; G. S. West, Brit. Freshw. Algae 220. *fig.* 92A. 1904.
III. Rice (rr).

SCENEDESMUS BIJUGA (Turb.) Lagerheim.

Nuova Notarisia 1893: p. 158; G. S. West, Brit. Frsehw. Algae 220. *fig.* 92C. 1904.
II. Mill (rr), Silver (rr).

SCENEDESMUS ARCUATUS Lemmermann.

Forschungsbr. a. d. Biol. Stat. zu Plön 7: 112. *pl.* 1, *figs.* 2–4. 1899.
II. Camp (rrr), Center (ss), Paddock (rrr).
III. Beaverdam (rr), Lac Court Oreilles (rrr), Owen (rrr), Reserve (rr), Shell (rrr).

var. **capitatus** var. nov.

Cells with nodular thickening at poles. Dimens. cells, 11–23 x 5–11 μ. (Plate **11**, figs. **4–5**).

II. Center (rr).

var. PLATYDISCA G. M. Smith.

Trans. Wis. Acad. Sci. Arts. & Lett. 18[2]: 451. *pl.* 30, *figs.* 101–105. 1916.
I. Pine (rr.)
II. Camp (rrr), Eagle (rr), Paddock (rr).

SCENEDESMUS DENTICULATUS Lagerheim.

Öfvers. Kgl. Vet.-Ak. Förh. 39: No. 2: 61. *pl.* 2, *figs.* 13–17. 1882.
II. Browns (rr), Silver (rrr).
III. Amicoy (rr).

SCENEDESMUS ACUTIFORMIS Schröder.

Forschungsbr. a. d. Biol. Stat. zu Plön 5: 45. *pl.* 2, *figs.* 4a–4b. 1897.
III. Rice (rrr).

SCENEDESMUS BRASILIENSIS Bohlin.

Bih. t. Kgl. Vet.-Ak. Handl. 23: Afd. 3: No. 7: 22. *pl.* 1, *figs.* 36–37. 1897.
III. Beaverdam (rrr), Prairie (rr), Rice (rr).

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SCENEDESMUS ARMATUS (Chodat) G. M. Smith

Trans. Wis. Acad. Sci. Arts & Lett. 18²: 460. *pl.* 29, *figs.* 90–93. 1916.
II. Browns (rr), Silver (rr).
III. Reserve (rrr).

SCENEDESMUS ABUNDANS (Kirchner) Chodat.

Matér. p. la flora crypt. Suisse 4²: 77. 1913; G. M. Smith, Trans. Wis. Acad. Sci. Arts. & Lett. 18²: 465. *pl.* 31, *figs.* 137–140. 1916.
I. Oconomowoc (rr).

var. LONGICAUDA G. M. Smith.

Trans. Wis. Acad. Sci. Arts. & Lett. 18: ²: 467. *pl.* 30, *figs.* 121–125. 1916.
II. Camp (rr).
III. Rice (rr).

SCENEDESMUS LONGUS Meyen.

Nova Acta Acad. Phys.–Med. Leop.–Caes. Nat. Cur. 14: 774. *pl.* 43, *f.* 28. 1829.
II. Camp (rr).

SCENEDESMUS QUADRICAUDA (Turp.) de Bréb.

Mem. de la Soc. Ac. de Falaise 1835: 66, G. S. West, Brit. Freshw. Algae 220, *figs.* 92D–92F. 1904.
II. Browns (rr), Camp (rr), Eagle (rr), Mary (rr) .
III. Beaverdam (rr), Chetek (rr), Pokegama (rrr), Rice (r).

var. WESTII G. M. Smith.

Trans. Wis. Acad. Sci. Arts. & Lett. 18²: 480. *pl.* 32, *figs.* 177–180. 1916.
II. Camp (rr), Silver (rr).
III. Lac Court Oreilles (rr).

var. MAXIMUS W. & G. S. West.

Trans. Linn. Soc. Bot. 2nd. Ser. 5: 83. *pl.* 5, *figs.* 9–10. 1895.
II. Eagle (rr).

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Genus CRUCIGENIA Morren 1830.

Crucigenia rectangularis (Nägeli) Gay.

Recherches sur le dév. et la class. de quelques algues vertes 100. *pl.* 15, *f.* 151. 1891.

II. Mill (rrr), Paddock (rr).

III. Beaverdam (rr), Lac Court Oreilles (rrr).

Crucigenia irregularis Wille.

Biol. Cent. **18**: 302. 1898; Nyt. Mag. f. Naturvidensk **38**: 10, *pl.* 1, *f.* 15. 1900; W. & G. S. West, Trans. & Proc. Bot. Soc. Edinburg **23** [1]: 29, *pl.* 1, *figs.* 6–7. 1905.

The cells of some of the smaller colonies from the plankton of Browns Lake were regularly arranged in the coenobe. This suggests a very large variety of *C. rectangularis* (Nägeli) Gay but I consider them colonies of *C. irregularis*. In addition to differences in cellular arrangement, the two species differ considerably in size so that the two need not be confused even though the cells are at times regularly arranged. Although most investigators state that pyrenoids are not found in the chloroplasts of *C. irregularis*, I have generally found them present. (Plate **11**, figs. **2–3**).

II. Browns (rr), Camp (rr).

III. Reserve (rrr).

Crucigenia lauterbornei Schmidle.

Allg. Bot. Zeits. **6**: 234. 1900; Chodat, Matér. p. 1. fl. crypt. Suisse **1** [3]: 206. *fig.* 127. 1902.

Cells 4. 5–9 μ, wide, 8–15 μ long. Coenobes 15–25 μ in diam. Multiple coenobia up to 150 μ in diam.

In the formation of the young coenobia, there is a rupture of the cell wall into two and not four parts as is generally stated. The gelatinous sheath enclosing the colony is very delicate and easily overlooked. The statement is generally made that the coenobes are held together by the gelatinous sheath of the colony. This sheath may play a part in holding the cells of the colony together, but the remnants of the old mother cell wall are also important and play the same rôle as in *Dictyosphaerium*, *Westella* and *Dimorphococcus*. (Plate **12**, fig. **1**).

III. Chetek (rrr), Pokegema (rr), Prairie (rr), Rice (rr).

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Genus COELASTRUM Nägeli 1849.

COELASTRUM MICROPORUM Nägeli.

In Braun, Alg. Unicell. 70. 1855; Senn. Bot. Ztg. 57: 53. *pl.* 2, *figs.* 11–17. 1899.

II. Browns (rr), Center (rr), Elizabeth (rr), Mary (rr), Mill (rrr), Silver (rr).

III. Bear (rr), Chetac (rr), Granite (rr), Island (rr), Prairie (rrr), Shell (rrr), Vermilion (rr).

COELASTRUM CAMBRICUM Archer.

Quart. Jour. Micr. Sci. N. S. 8: 65. 1868; W. West, Jour. of Bot. 31: 99. *pl.* 333, *f.* 14. 1893.

II. Silver (rr).

III. Beaverdam (rr), Owen (rrr), Prairie (rrr).

COELASTRUM RETICULATUM (Dang.) Senn.

Bot. Ztg. 57: 66. *pl.* 2, *figs.* 1–10. 1899.

II. Browns (sss), Camp (r), Eagle (rr), Mary (rr).

III. Bear (rr), Beaverdam (rr), Birch (rrr), Lac Court Oreilles (rr), Reserve (rr), Rice (rr).

Genus SORASTRUM Kützing.

SORASTRUM AMERICANUM (Bohl.) Schmidle.

Engl. Jahrb. 27: 230. Lemmermann, Arch. f. Hydrobiol. u. Planktonkde. 5: 310. *f.* 5. 1910.

Little is known concerning the manner of reproduction of this alga, the general assumption being that it forms autospores in the same manner as *Coelastrum.* Many of the cells of the colonies from Devils Lake had lost their contents through a silt-like opening, while the very young colonies of the variety *undulatum* were enclosed in a hyaline gelatinous envelope (fig. **6**).

This suggests a formation of zoospores as in *Pediastrum* but the genus is left in the conventional place until these have been observed. (Plate **13**, figs. **6**, **8**).

III. Devils (rr).

var. **undulatum** var. nov.

Sides of base of stipe forming central sphere undulate instead of straight. (Plate **13**, fig. **7**).

III. Beaverdam (rrr).

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Family PLANOSPORACEAE.
Genus CHARACIUM A. Br. 1849.

CHARACIUM STIPITATUM (Bachm.) Wille.

In Engler & Prantl, Nat. Pflanzenfam. 1[2]: (Nachtr.) 45. 1909; G. M. Smith. Bull. Torr. Bot. Cl. 43: 472. *pl.* 24, *figs.* 4–6. 1916.

This species is confined exclusively to *Coelosphaerium Naegelianum* Unger.

III. Amicoy (r), Beaverdam (sss), Devils (ss), Horseshoe (ss).

Characium curvatum sp. nov.

Cells lunar or recurved, with acute or sub-acute apices. Stipe hyaline, thick, tubular or conical, frequently with an irregular outline. Chloroplast parietal, with or without a pyrenoid. (Plate 11, figs. 6–13).

Length of cell (with stipe) 13–22 μ, (without stipe) 8–18 μ; Breadth 3–6 μ. Epiphytic upon *Coelosphaerium Naegelianum* Unger, *Dictyosphaerium pulchellum* Wood, and *Phaeococcus planctonicus* W. & G. S. West.

The general manner of growth suggests *C. stipitatum* (Bachm.) Wille but this alga has curved cells and a much broader stipe. Whenever the host colony contains the alga, 50–200 individuals are generally present. It has been found in the sheath of colonial forms of the Myxophyceae, Chlorophyceae and Phaeopnyceae, which further distinguishes it from *C stipitatum* that is confined to a single alga.

III. Birch (cc), Chetac (a), Dummy (rr), Horseshoe (ss), Shell (ss).

CHARACIUM LIMNETICUM Lemmermann.

Bot. Not. 1903: 81. *pl.* 3, *figs.* 7–10.

The dimensions of the alga found in Browns lake agree in general with those given by Lemmermann but the cells attain a larger size, the largest being 110 μ long and 12 μ wide. The chloroplast contains one and not two pyrenoids. The stipe of the Wisconsin form differs from that described by Lemmermann in being somewhat thicker and without a basal disc. Lemmermann thinks that the 4 band-shaped chloroplasts represents stages in the cleavage of the cell contents to form zoospores. I

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have found that 4–8 chloroplasts are constantly present in the larger cells and consider this presence of several parietal cylindrical chloroplasts the normal condition of the vegetative cell and not a stage in its reproduction. The species also resembles *C. gracilipes* Lambert but only reaches the minimal dimensions of C. *gracilpes.* (Plate **11, figs. 14–18**).

II. Browns (r), Delavan (rrr).

Family HYDRODICTYACEAE
Genus PEDIASTRUM Meyen 1829

PEDIASTRUM SIMPLEX var. DUODENARIUM (Bailey) Rabenhorst.

Flora Eur. Algarum **3**: 72. 1868.

Monactinus duodenarius Bailey, Smithsonian Cont. to Knowl. **7**: Art. 3; 14. *pl.* 1, *fig.* 37. 1855.

Monactinus octonarius Baley, *ibid:* 14. *pl.* 1, *f.* 36.

Pediastrum enoplon W. & G. S. West, Trans. Linn. Soc. Bot. 2nd. Ser. **5**: 81. *pl.* 5, *figs.* 1–2. 1895.

Pediastrum clathratum var. *asperum* Lemmermann, Zeits. f. Fischeri u. d. Hilfsw. 1897: 180; Forschungsbr. a. d. Biol. Stat. zu Plön **7**: 114, *pl.* 2, f. 26.

Pediastrum clathratum var. *punctatum* Lemmermann, Zeits. f Fischeri u. d. Hilfsw. 1897: 182. *f.* 5.

Pediastrum simplex var. *radians* Lemmermann, Forschungsbr. a. d. Biol. Stat. zu Plön **7**: 114. *pl.* 2, *figs.* 24–25. 1899.

Pediastrum clathratum var. *microporum* Lemmermann, Forschungsbr. a. d. Biol. Stat. zu Plön **7**: 114, *pl.* 2, *figs.* 29–31. 1899.

Pediastrum clathratum var. *Baileyanum* Lemmermann, Forschungsbr. a. d. Biol. Stat. zu Plön **7**: 115, *Pl.* 2 *figs.* 26–28. 1899.

Pediastrum simplex var. *clathratum* Chodat, Matér. p. l. fl. crypt. Suisse **1**[2]: 225. *figs.* 149A–149D. 1902.

Pediastrum simplex var. *annulatum* Chodat, *ibid.* 225. *fig.* 149B.

Pediastrum clathratum var. *major* Schmidle, Bot. Jahrb. f. Syst. Pflanzengesch. u. Pflanzengeogr. **32**: 84. *pl.* 3, *f.* 17. 1903.

The nomenclature of the species of *Pediastrum* with single spines is in almost hopeless confusion. West (Journ. Linn. Soc. Bot. *38:* 135. 1907) states that "it is impossible to recognize more than one species, and for the specific name I have retained Meyen's old name *Pediastrum simplex.*" Lemmermann (Hedwigia *48:* 131. 1909) takes exception to West's statement and holds that according to this reasoning the forms with two projections on the cell should all be grouped in one collective species. He recognizes four species *P. simplex* (Meyen) Lemmermann

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emend., *P. clathratum* (Schröt) Lemm., *P. Sturmii* Reinsch, and *P. ovatum* (Ehrenb.) A. Br.

One horned forms were sufficiently common in the plankton catch from Vermilion lake to afford ample material for studying the range of variation. The typical *P. simplex* cells have concave sides and no, or very small, intercellular spaces between them. I have never observed this condition in any of the Wisconsin material, the intercellular spaces always being as large as the cells. This form is commonly called *P. clathratum* (Schröt.) Lemmermann, but since it differs from the typical *P. simplex* in the same manner that the varieties *clathratum* and *reticulatum* differ from *P. duplex* Meyen there is no reason for considering it a distinct species. Bailey's figures of *Monactinus duodenarius* is so clear cut that there is no doubt but that *P. clathratum* is identical with it.

The punctation or granulation of the wall is so variable that it cannot be used for distinguishing varieties; while those varieties based upon arrangement of the interior cells of the coenobe are also worthless. (Plate **13**, fisg. **1–5**).

II. Camp (rr), Mary (rrr), Silver (rr).
III. Bear (r), Rice (r), Vermilion (cc).

Pediastrum boryanum (Turp.) Menegh.

Linnaea **14**: 210. 1840; G. S. West, Brit. Freshw. Algae 211. *figs.* 85F–85H. 1904.

II. Browns (rr), Camp (s), Center (s), Eagle (sss), Elizabeth (ss), Green (rrr), Hooker (rr), Mary (ss), Mill (rrr), Paddock (rrr), Silver (r).

III. Bear (ss), Beaverdam (ss), Chetac (rrr), Chetek (rrr), Granite (rrr), Grindstone (rr), Horseshoe (ss), Lac Court Oreilles (rr), Owen (r), Prairie (rrr), Pokegama (rrr), Reserve (rr), Rice (rr), Vermilion (rr), Whitefish (rr).

Pediastrum glanduliferum Bennett.

Jour. Roy. Micr. Soc. **1892**: 7. *pl.* 2, *figs.* 5–7. 1892.
III. Horseshoe (rrr).

Pediastrum araneosum (Racib.) G. M. Smith.

Bull. Torr. Bot. Cl. **43**: 476. 1916.
III. Horseshoe (rr).

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PEDIASTRUM DUPLEX Meyen.

Nova acta Phys. Med. Ac. Caes.-Leop. Nat.-Cur. 14²: 772. *pl.* 43, *figs.* 6–8. 1829.

II. Browns (rr), Center (r), Eagle (r).

var. CLATHRATUM (A. Br.) Lagerheim.

Öfvers. Kgl. Vet. Ak. Förh. 39: No. 2: 56. 1882.

II. Camp (s), Mary (r).

III. Bear (rr), Beaverdam (sss), Chetek (s), Rice (ss).

var. RETICULATUM Lagerheim.

Öfvers. Kgl. Vet.-Ak. Förh. 39: No. 2: 56. *pl.* 2, *f.* 1. 1882.

II. Camp (s), Center (s), Hooker (rr), Paddock (rr).

III. Chetek (s), Island (sss), Little Rice (ss), Pokegama ss), Prairie (ss), Rice (s), Reserve (rr), Whitefish (rr).

var. ROTUNDATUM Lucks.

Jahrb. d. Westpr. Lehrervereins f. Naturkde 2: 31. 1907.

III. Horseshoe (rr).

PEDIASTRUM BIRADIATUM Meyen.

Nova Acta Ac. Caes.-Leop. Nat.-Cur. 14²: 775. *pl.* 43, *figs.* 21–22. 1829.

Lagerheim, Öfvers. Kgl. Vet.-Ak. Förh. 39: No. 2: 55. *pl.* 2, *figs.* 2–7,9,11. 1882.

The few colonies observed were of the same irregular type that Lagerheim has figured.

III. Bear (rr).

PEDIASTRUM TETRAS (Ehr.) Ralfs.

Ann. & Mag. of Nat. Hist. 14: 469. *pl.* 12, *f.* 4. 1844.

II. Browns (rr).

II. Beaverdam (rrr), Chetek (rr).

Order **ULOTRICHALES**

Family APHANOCHAETACEAE

Genus APHANOCHAETE A. Br. 1851.

APHANOCHAETE VERMICULOIDES Wolle (Plate 5, fig. 1).

Freshw. algae of U. S. 119. *pl.* 105, *figs.* 9–10. 1887.

Herposteiron hyalothecae Hansgirg, Sitzbr. d. k. böhm. Ges. d. Wiss. Prag. 1891: 309. 1891.

III. Beaverdam (rr).

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Order **CONJUGALES**

Family DESMIDIACEAE.

Genus NETRIUM Nägeli 1849; Lütkem. emend. 1902.

NETRIUM DIGITUS (Ehr.) Itzigs. u. Rothe.

In Rabenhorst, Algen No. 508. 1856. W. & G. S. West, Monogr. of Brit. Desm. 1: 64. *pl.* 6, *figs.* 14–16. 1904.
I. Squirrel (rrr).

Genus CLOSTERIUM Nitzsch 1817.

CLOSTERIUM ACICULARE var. SUBPRONUM (W. West) W. & G. S. West.

Monogr. of Brit. Desm 1: 175. *pl.* 23, *figs.* 4–5. 1904.
Closterium subpronum var. *lacustre* Lemmermann, Abh. Natw. Ver. Bremen 16: 344. *pl.* 1, *figs.* 13–14. 1899.

The dimensions of the cells are those of *C. subpronum* var. *lacustre* Lemmermann but since the Wests state that "*Closterium subpronum* var. *lacustre* should be relegated to this variety although the dimensions are a little larger," I have followed their practice.

I. Green (r).

Genus MICRASTERIAS C. A. Agardh 1827.

MICRASTERIAS PINNATIFIDA (Ktz.) Ralfs.

Brit. Desm. 77. *pl.* 10, *figs* 3a–3b. 1848.
I. Kawaguesaga (rrr).

MICRASTERIAS TRUNCATA (Corda) de Bréb.

In Ralfs, Brit. Desm. 75. *pl.* 8, *fig.* 4; *pl.* 10, *fig.* 5. 1848.
I. Soft (sss).
III. Beaverdam (rr), Chetek (rrr).

MICRASTERIAS SOL (Ehr.) Kützing.

Species algarum 171. 1849; W. & G. S. West, Monogr. of Brit. Desm. 2: 95. *pl.* 46, *figs.* 1–2. 1905.
Micrasterias radiosa Ralfs non C. A. Agardh. Ralfs. Brit. Desm. 72. *pl.* 8, *fig.* 3. 1848.
III. Beaverdam (rr).

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Micrasterias radiata Hassall.

Hist. Brit. Freshw. Algae 386. *pl.* 90, *f.* 2. 1845; W. & G. S. West, Monogr. of Brit. Desm. 2: 113. *pl.* 52, *figs.* 1–9. 1905.
Micrasterias furcata Ralfs non C. A. Agardh. Ralfs, Brit. Desm. 73. *pl.* 9, *f.* 2. 1848.
I. Kawaguesaga (rrr).
III. Beaverdam (rrr), Horseshoe (rrr).

Micrasterias americana (Ehr.) Ralfs.

Brit. Desm. p. XIX. 1848.
Micrasterias morsa Ralfs, Brit. Desm. 74. *pl.* 10, *f.* 1. 1848.
I. Found (rr).
III. Horseshoe (rrr).

Genus COSMARIUM Corda 1834.

Cosmarium contractum Kirchner.

Algen I, in Cohn, Kryptogamenfl. Schlesien 2: 147. 1878; Wille, Christiana Vid.-Selsk. Förh. 1880: No. 11: p. 33. *pl.* 1, *f.* 19. 1880.
III. Horseshoe (rr), Shell (s).

var. jacobsenii (Roy) W. & G. S. West.

Monogr. of Brit. Desm. 2: 171. *pl.* 61, *f.* 26. 1905.
I. Mendota (rr).

Cosmarium moniliforme var. limneticum W. & G. S. West.

Monogr. of Brit. Desm. 3: 23. *pl.* 67, *figs.* 6–7. 1908.
III. Lac Court Oreilles (rr).

Cosmarium botrytis (Bory de St. incent) Menegh.

Linnaea 14: 220. 1840; Ralfs, Brit. Desm. 99. *pl.* 16, *f.* 1. 1848.
III. Number One (rrr).

Cosmarium protractum (Nägeli) de Bary.

Unters. u. d. Fam. d. Conj. 72. 1858.
Euastrum protractum Nageli, Gatt. einz. Algen 119. *pl.* 7, *fig.* A[a]. 1849.
I. Okauchee (rrr).

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Genus XANTHIDIUM Ehrenberg 1834.

XANTHIDIUM SUBHASTIFERUM W. West.

Jour. Linn. Soc. Bot. 29: 166. *pl.* 22, *f.* 4. 1892.
I. Birch (ss), Catherine (rr), Catfish (sss), Cranberry (sss), Kawaguesaga (rr), No Mans (ss), Rock (r), Sishebogema (rr), Squirrel (rr), Tamarack (rr), North Turtle (rr).
III. Bear (rr), Beaverdam (s), Horseshoe (s), Shell (cc).

XANTHIDIUM ANTILOPAEUM var. DEPAUPERATUM W. & G. S. West.

Trans. & Proc. Bot. Soc. Edinburgh 23: 23. *pl.* 1, *figs.* 15–16. 1905.
I. Otter (rr).

XANTHIDIUM ANTILOPAEUM var. POLYMAZUM Nordstedt.

Acta Univ. Lunds 9: 38. *pl.* 1, *f.* 20. 1873.
I. Cranberry (rrr), Found (rr), George (rr).
III. Beaverdam (ss), Horseshoe (rr).

XANTHIDIUM CRISTATUM var. LEIODERMUM (Roy & Biss.) Turner.

Kgl. Sv. Vet.-Ak. Handl. 25: No. 5: 99. *pl.* 12, *f.* 33. 1892.
III. Chetek (rrr), Island (rrr).

Genus ARTHRODESMUS Ehrenberg 1838.

ARTHRODESMUS INCUS var. RALFSII forma LATIUSCULA W. & G. S. West.

Monogr. of Brit. Desm. 4: 96. *pl.* 114, *f.* 5. 1912.
II. George (rr), Pardee (rr).
III. Dummy (rrr), Horseshoe (rr).

ARTHRODESMUS TRIANGULARIS Lagerheim.

Öfvers. Kgl. Vet.-Ak. Förh. 42: No. 7: 244. *pl.* 27, *f.* 22. 1885.
III. Dummy (rr).

var. INFLATUS W. & G. S. West.

Jour. Linn. Soc. Bot. 33: 320. 1898; Monogr. of Brit. Desm. 4: 99. *pl.* 114, *figs.* 14–15. 1912.
III. Horseshoe (rr).

var. INFLATUS forma ROBUSTA W. & G. S. West.

Monogr. of Brit. Desm. 4: 99. *pl.* 114, *f.* 16. 1912.
III. Shell (rr).

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ARTHRODESMUS QUIRIFERUS W. & G. S. West.

Jour. Linn. Soc. Bot. 35: 542. *pl.* 17, *figs.* 9–10. 1903.
I. Speese (rr), Squirrel (rr).

ARTHRODESMUS SUBULATUS Kützing.

Species algarum 176. 1849; W. & G. S. West, Trans. Linn. Soc. Bot. 2nd. Ser. 5: 72. *pl.* 9, *figs.* 32–33. 1895.
II. George (rr), Meta (rr).

Genus STAURASTRUM Meyen 1829.

STAURASTRUM DICKIEI Ralfs.

Brit. Desm. 123. *pl.* 21. *f.* 3. 1848.
III. Beaverdam (rrr).

STAURASTRUM MEGACANTHUM Lundell.

Nova acta r. soc. sci. Upsaliensis. 3. Ser. 8: 61. *pl.* 4, *f.* 1. 1871.
I. South Turtle (rr).
III. Lac Court Oreilles (ss), Reserve (sss), Whitefish (cc).

var. SCOTICUM W. & G. S. West .

Jour. Linn. Soc. Bot. 35: 544. *pl.* 16, *f.* 8. 1903.
III. Horseshoe (rr), Shell (c).

STAURASTRUM ORBICULARE (Ehrenb.) Menegh.

Linnaea 14: 225. 1840.
III. Beaverdam (rrr).

STAURASTRUM MUCRONATUM var. DEBARYANUM (Nordst.) Turner.

Kgl. Sv. Vet.-Ak. Handl. 25: no. 5: 105. *pl.* 16, *f.* 20. 1892.
III. Silver (rr), Whitefish (rr).

STAURASTRUM PILOSUM (Nägeli) Archer.

In Pritchard, Infusoria. 4th. Ed. 739. 1861; Cleve, öfvers. Kgl. Sv. Vet.-Ak. Förh. 20: No. 10: 490. *pl.* 4, *f.* 3. 1863
III. Dummy (rrr).

STAURASTRUM DENTICULATUM (Nägeli) Archer.

In Pritchard, Infusoria. 4th. Ed. 738. 1861: W. & G. S. West, Trans. R. Ir. Acad. 33: Sec. B. 103. *pl.* 11, *f.* 11. 1906.
III. Bear (r), Beaverdam (rr), Duck (r), Granite (rrr), Horseshoe (rr), Lac Court Oreilles (ss), Shell (ss), Whitefish (rr).

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Staurastrum brachiatum Ralfs.

Brit. Desm. 131. *pl.* 23, *f.* 9. 1848.
III. Dummy (s).

Staurastrum paradoxum Meyen.

Nova Acta. Phys.-med. Ac. Caes.-Leop. Nat.-Cur. 14²: 777. *pl.* 43, *figs.* 37–38. 1829; W. & G. S. West, Jour. Linn. Soc. Bot. 35: 548: *pl.* 18, *f.* 5. 1903.
III. Shell (sss).

var. longipes Nordstedt.

Acta. Univ. Lunds 9: 35. *pl.* 1, *f.* 17. 1873; W. & G. S West Trans. R. Soc. Edinburgh 41: 504. *pl.* 7, *figs.* 13–14. 1905.
I. Devils (sss), Fowler (rr), Lac la Belle (rrr).
II. Center (sss), Hooker (rr).
III. Chetek (rr), Dummy (r), Granite (ss), Whitefish (ss).

Staurastrum manfeldtii var. annulatum W. & G. S West.

Trans. R. Irish. Acad. 32: Sec. B: 56. *pl.* 1, *figs.* 30–31. 1902.
III. Dummy (rr).

Staurastrum gracile var. bulbosum W. West.

Jour. Linn. Soc. Bot. 29: 182. *pl.* 23, *f.* 11. 1892.
III. Duck (s), Dummy (ss).

Staurastrum leptocladum var. cornutum Wille.

Bih. t. Kgl. Sv.-Vet. Ak. Handl. 8: No. 18: 19. *pl.* 1, *f.* 39. 1884.
III. Horseshoe (ss).

Staurastrum leptocladium var. divergens Wolle.

Desm. U. S. 1st. Ed. 136. *pl.* 44, *f.* 5. 1884.
III. Lac Court Oreilles (r), Whitefish (sss).

Staurastrum ophiura Lundell.

Nova acta r. soc. sci. Upsaliensis, 3, Ser. 8: 69. *pl.* 4, *f.* 7. 1871.
III. Horseshoe (rrr).

Staurastrum arachnoides W. West.

Jour. Linn. Soc. Bot. 29: 186. *pl.* 24, *f.* 4. 1892.
III. Devils (rr), Horseshoe (rr).

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Staurastrum fucigerum de Bréb.

In Meneghini, Linnaea 14: 226. 1840.
Didymocladon fucigerus (de Bréb) Ralfs. Brit. Desm. 144. *pl.* 33, *f.* 12. 1848.
III. Duck (c), Granite (rr).

Staurastrum leptacanthum Nordstedt.

Vidensk. Medd. d. naturh. Foren. i. Kjobenhavn. 1869: 229. *pl.* 4, *f.* 46. 1870.
III. Dummy (rr), Horseshoe (rr).

Staurastrum arctiscon, (Ehr.) Lundell.

Nova acta r. soc. sci. Upsaliensis, 3, Ser. 8: 70. *pl.* 4, *f.* 8. 1871.
III. Silver (rrr).

var. glabrum W. & G. S. West.

Trans. Linn. Soc. Bot. 2, Ser. 5: 269. *pl.* 18, *f.* 14. 1896.
I. Devils (rrr), Muskallonge (rr), Soft (cc).

Genus COSMOCLADIUM de Bréb. 1856.

Cosmocladium saxonicum de Bary.

Flora 48: 321. *pl.* 4, *figs.* 1–3. 1865.
I. Devils (ccc), Squirrel (rr), North Turtle (sss).
III. Beaverdam (rr).

Genus SPHAEROZOSMA Corda 1835.

Sphaerozosma pulchrum Bailey.

In Ralfs, Brit. Desm. 209. *pl.* 35, *f.* 2. 1848.
I. Nell (rr).

Sphaerozosma aubertianum W. West.

Jour. of Bot. 27: 206. *pl.* 291, *f.* 17. 1889; W. & G. S. West, Trans. R. Soc. Edinburgh 41: 505. *pl.* 6, *f.* 7. 1905.
I. Devils (rr), Razorback (rrr).

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Genus SPONDYLOSIUM de Bréb.

Spondylosium planum (Wolle) W. & G. S. West.

Jour. Linn. Soc. Bot. 40: 430. *pl.* 19, *figs.* 5–8. 1912.
I. Catfish (rr), Cranberry (rr), Devils (r), Found (r), Rock (rrr).
III. Beaverdam (rr), Horseshoe (rr), Lac Court Oreilles (r), Reserve (r), Shell (s), Whitefish (rr).

Spondylosium papillosum W. & G. S. West.

Trans. Linn. Soc. Bot. 2 Ser. 5: 43. *pl.* 9, *f.* 19. 1895.
III. Devils (rr).

Spondylosium moniliforme Lundell.

Nova acta r. soc. sci. Upsaliensis 3 Ser. 8: 92. *pl.* 5, *f.* 16. 1871.
III. Beaverdam (rr).

Genus ONYCHONEMA Wallich 1860.

Onychonema laeve var. micracanthum Nordstedt.

Acta. Univ. Lunds 16: 3. 1880; Johnson, Bull. Torr. Bot. Cl. 21: 286. *pl.* 211, f. 15. 1894.
I. Devils (sas), Soft (rrr).
III. Beaverdam (rrr), Devils (rr).

Genus HYALOTHECA Ehrenberg 1841.

Hyalotheca dissiliens (Smith) de Bréb.

In Ralfs, Brit. Desm. 51. *pl.* 1, *f.* 1. 1848.
III. Beaverdam (r), Duck (rr).

Genus DESMIDIUM C. A. Agardh 1824.

Desmidium cylindricum Greville.

Scott. Crypt. Fl. 5: 293. *pl.* 293, *figs.* 1–3. 1827; Wolle, Desm. U. S. 1st. Ed. 25. *pl.* 3, *figs.* 1–4. 1884.
I. No Mans (rrr).

Desmidium swartzii C. A. Agardh.

Systema algarum 9. 1824; Ralfs, Brit. Desm. 61. *pl.* 4, *figs.* A–F. 1848.
I. Found (rr).
III. Beaverdam (rr), Lac Court Oreilles (rrr).

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DESMIDIUM BAILEYI Nordstedt.

Acta univ. Lunds **16**: 4. 1880; Kgl. Sv. Vet.-Ak. Handl. **22**: No. 8: 27. *pl.* 2, *figs.* 4–5. 1888.

I. Found (r).

Class HETEROKONTAE.

Order Heterococcales

Family BOTRYOCOCCACEAE
Genus BOTRYOCOCCUS Kützing 1849.

BOTRYOCOCCUS BRAUNII Kützing.

Species algarum 892. 1849; Fresenius, Abh. Senckenb. Naturf. Ges. **2**: 239. *pl.* 11, *figs.* 27–33. 1858.

The identity of the organism that Kützing named *B. Braunii* has been a matter of considerable discussion. Fresenius' account is of particular interest since he compared his material with material sent him by Braun from the original station (Neuenberger Lake). His figures, although small, are quite characteristic.

This alga was listed as *Ineffigiata neglecta* W. & G. S. West in the preliminary list, the *B. Braunii* of that list being *B. sudeticus* Lemmermann.

I. Beaver (rr).

II. Browns (ss), Camp (rrr), Center (s), Delevan (rrr), Elizabeth (rr), Green (rrr), Mary (sss), Mill (ss), Paddock (r), Silver (r).

III. Bear (rr), Beaverdam (ss), Birch (rr), Chetac (rr), Devils (rr), Grindstone (r), Horseshoe (rr), Lac Court Oreilles (sss), Little Rice (rr), Reserve (rr), Rice (rr), Shell (rr), Whitefish (rrr).

Botryococcus protruberans var. **minor** var. nov.

Cells half the size of the typical form. Length 8–9. 5μ, greatest breadth 5–6. 5 (Plate **14**, figs. **6–7**).

The typical form of this particular species was described from preserved material and the Wests were unable to determine the nature of the chloroplast. I have collected it in abundance from one lake and find that the chloroplast is distinctly parietal and occupies the greater portion of the wall in certain cases.

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The characteristic occurrence of small aggregates of four and eight cells, which forms the chief distinction between this and the other species of the genus, was also noted. Although I have observed many thousand colonies I have never noted the characteristic change to a yellowish color that the Wests describe.

I. George (a), Pardee (rr).

Family CHLOROBOTRYDACEAE
Genus CHLOROBOTRYS Bohlin 1901.

Chlorobotrys limneticus sp. nov.

Cells ovoid, irregularly distributed within a homogeneous, hyaline, gelatinous integument. 10–80 cells in each colony. Chromoplasts disc-shaped, parietal, 3–4 in each cell, without pyrenoids, pale yellow-green. (Plate **14**, fig. **10**).

Length of cells 6–8 μ, width 5–6 μ. Diam. colony 40–200 μ.

The general appearance of the colony is quite similar to *Phaeococcus planctonicus* W. & G. S. West but the color of the chromoplast is the typical yellow green of the Heterokontae.

I. Camp (rr).

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Explanation of Plates 10–15.

Plate 10

Figs. 1–2. *Gonium pectorale* Mueller, x 500.
Figs. 3–6. *Asterococcus limneticus* G. M. Smith (Fig. 4, x 500; Fgs. 3, 5, 6, x 1000).
Fig. 7. *Kirchneriella obesa* var. *major* (Bernard) G. M. Smith, x 1000.
Figs. 8–11. *Planktosphaeria gelatinosa* G. M. Smith, x 1000.

Plate 11

Fig. 1. *Ankistrodesmus lacustris* (Chodat) Ostenfeld, x 1000.
Figs. 2–3. *Crucigenia irregularis* Wille, x 1000.
Figs. 4–5. *Scenedesmus arcuatus* var. *capitatus* G. M. Smith, x 1000.
Figs. 6–13. *Characium curvatum* G. M. Smith, x 1000.
Figs. 14–18. *Characium limneticum* Lemmermann, x 1000.

Plate 12

Fig. 1. *Crucigenia Lauterbornei* Schmidle, x 1000.
Figs. 2–5. *Polyedriopsis spinulosa* Schmidle, x 1000.
Fig. 3. *Actinastrum Hantzschii* var. *elongatum* G. M. Smith, x 1000.
Fig. 4. *Micractinium pusillum* var. *elegans* G. M. Smith, x 1000.

Plate 13

Figs. 1–5. *Pediastrum simplex* var. *duodenarium* (Bailey) Rabenhorst, x 333.
Figs. 6–8. *Sorastrum americanum* (Bohlin) Schmidle, x 666.
Fig. 7. *Sorastrum americanum* var. *undulatum* G. M. Smith, x 666.

Plate 14

Fig. 1. *Aphanochaete vermiculoides* Wolle, x 400.
Figs. 2–4. *Dactylococcopsis acicularis* Lemmermann, x 1000.
Fig. 5. *Trichodesmium lacustre* Klebahn, x 1000.
Figs. 6–7. *Botryococcus protruberans* var. *minor* G. M. Smith, (Fig. 6 x 500, Fig. 7 x 1000.
Figs. 8–9. *Oocystis eremosphaeria* G. M. Smith, x 1000.
Fig. 10. *Chlorobotrys limneticus* G. M. Smith, x 1000.

Plate 15

Figs. 1–2. *Tetraedron verrucosum* G. M. Smith, x 1000.
Fig. 3. *Tetraedron gracile* (Reinsch) Hansgirg, x 1000.
Figs. 4–5. *Tetraedron proteiforme* (Turner) Brunnthaler, x 1000.
Figs. 6–7. *Oocystis natans* var. *major* G. M. Smith, (Fig. 6 x 500, fig. 7 x 1000.

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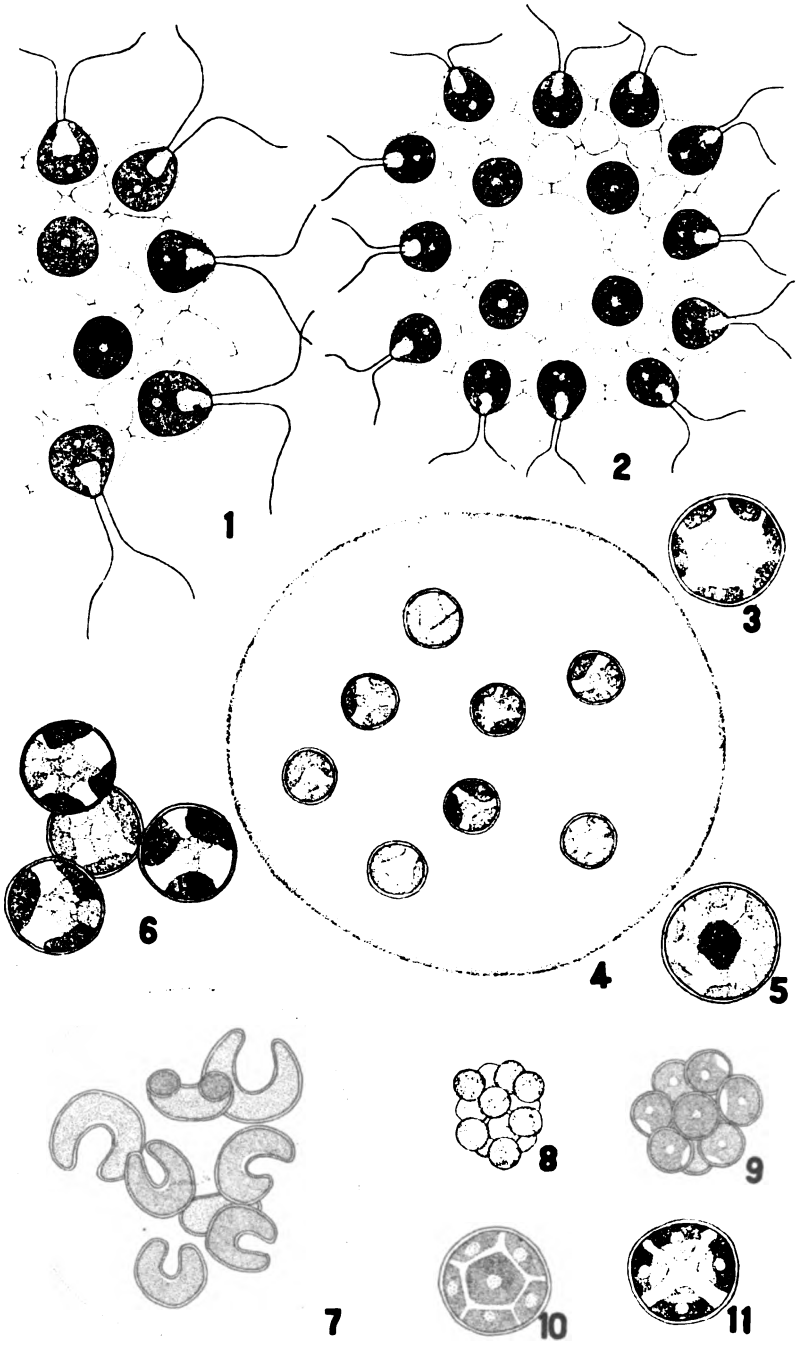

SMITH—ALGAE

COCKAYNE BOSTON

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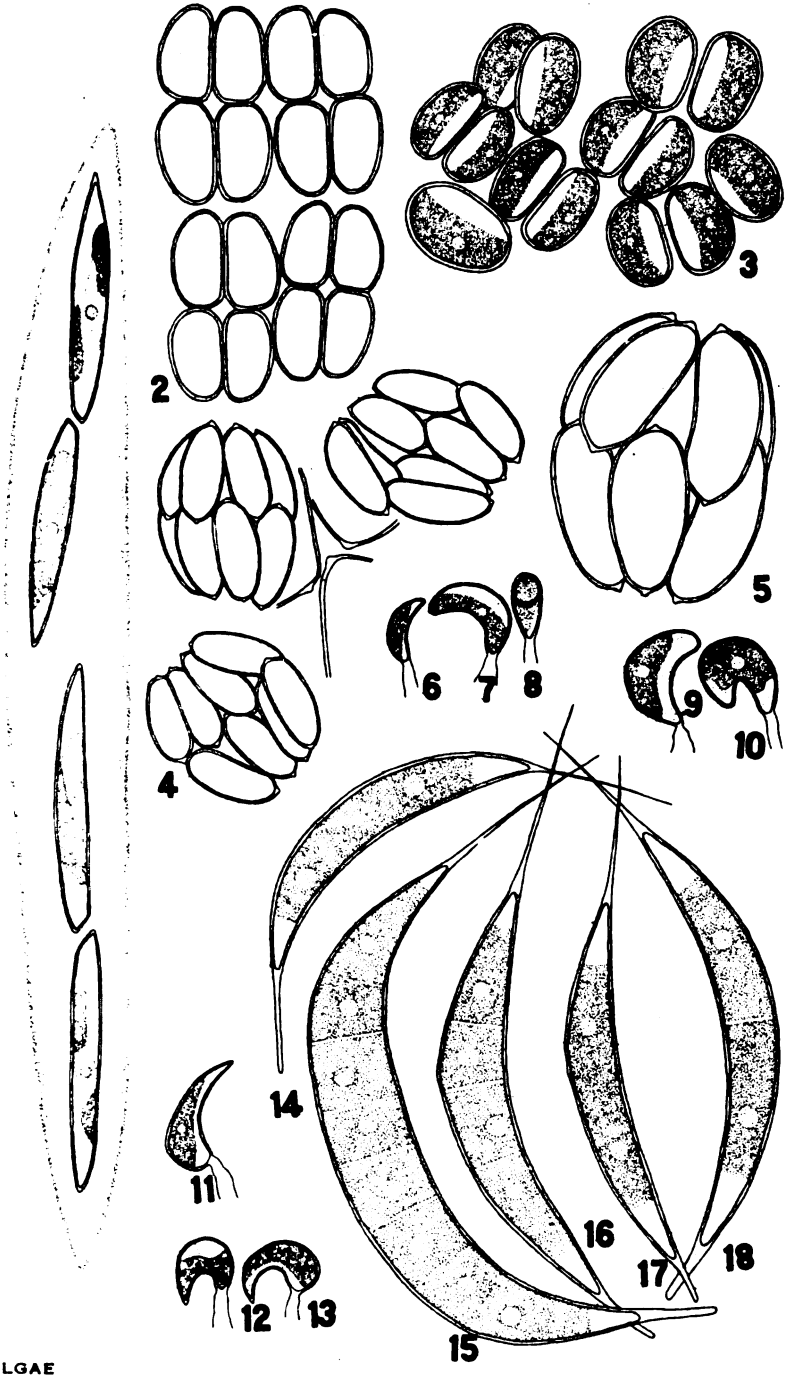

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COCKAYNE, BOSTON

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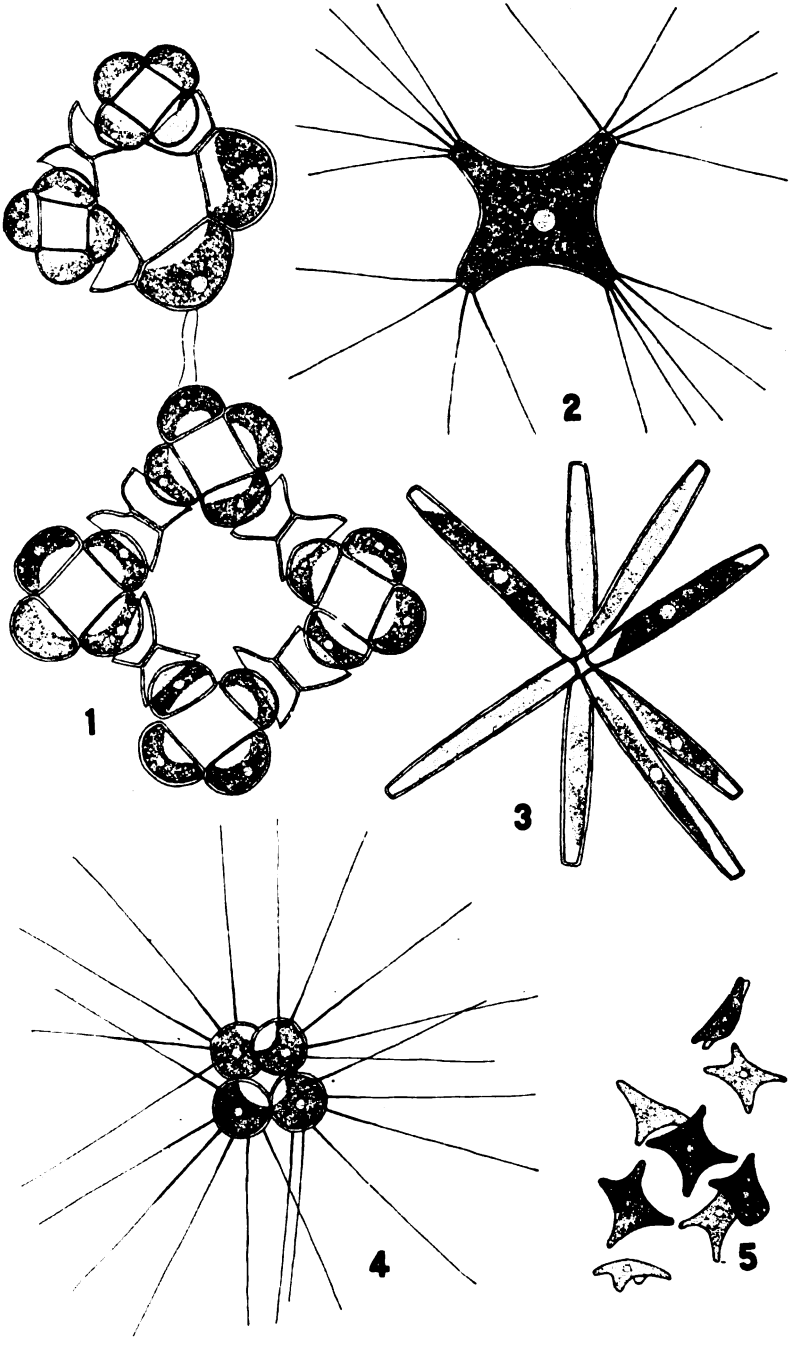

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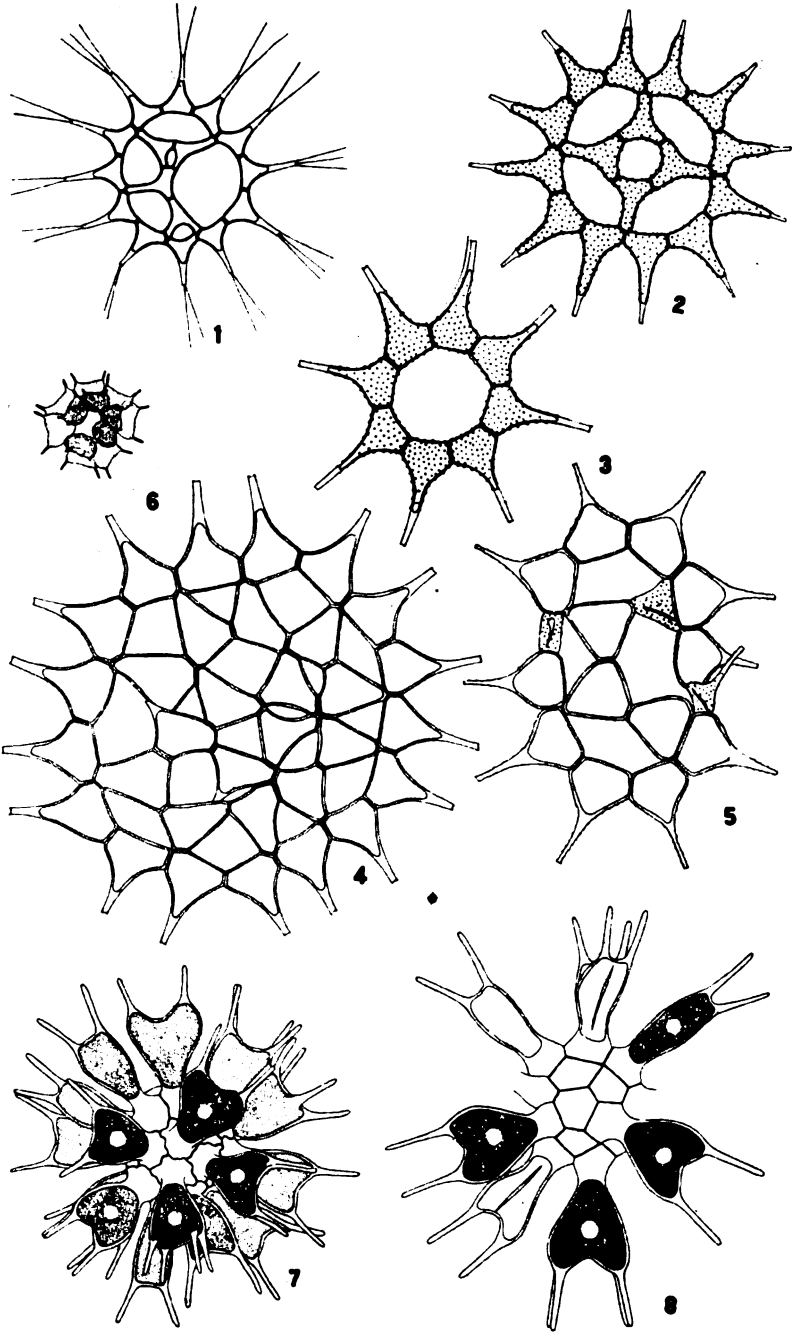

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COCKAYNE, BOSTON

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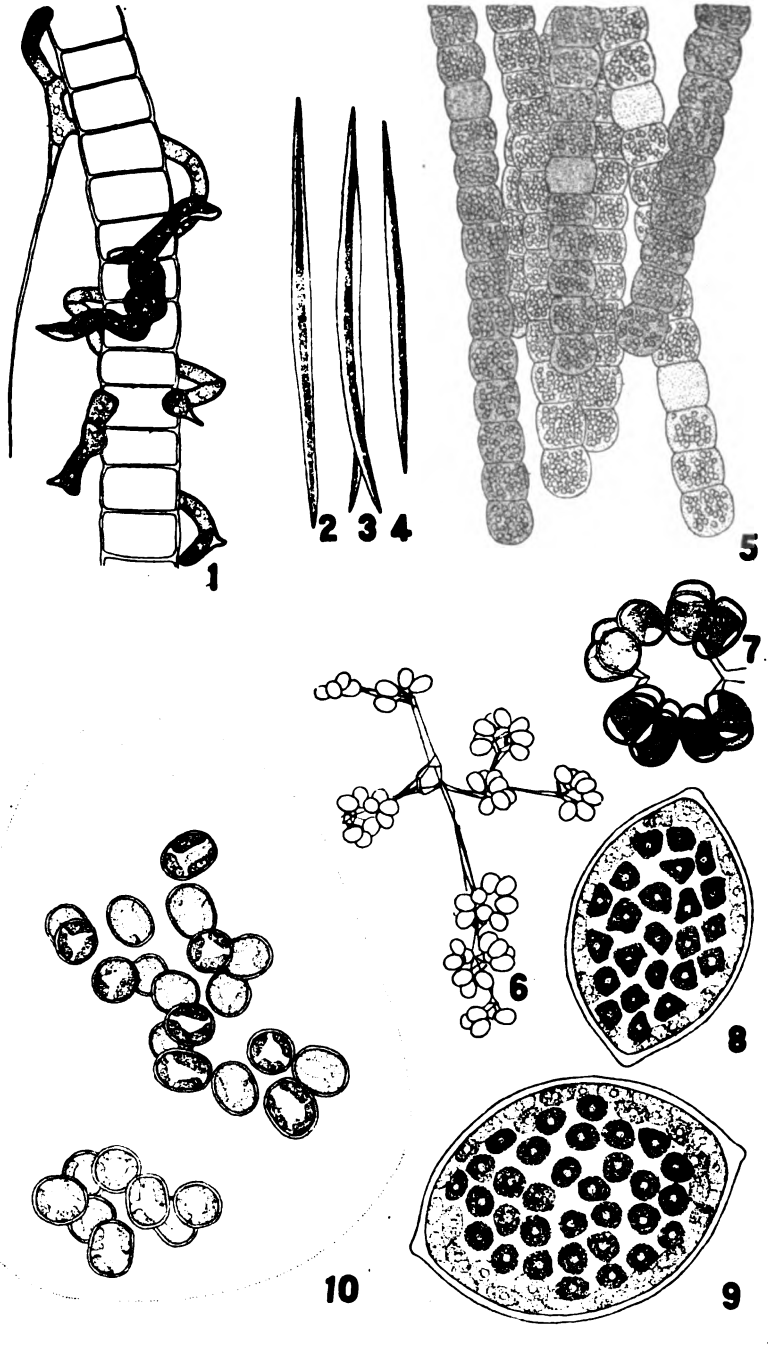

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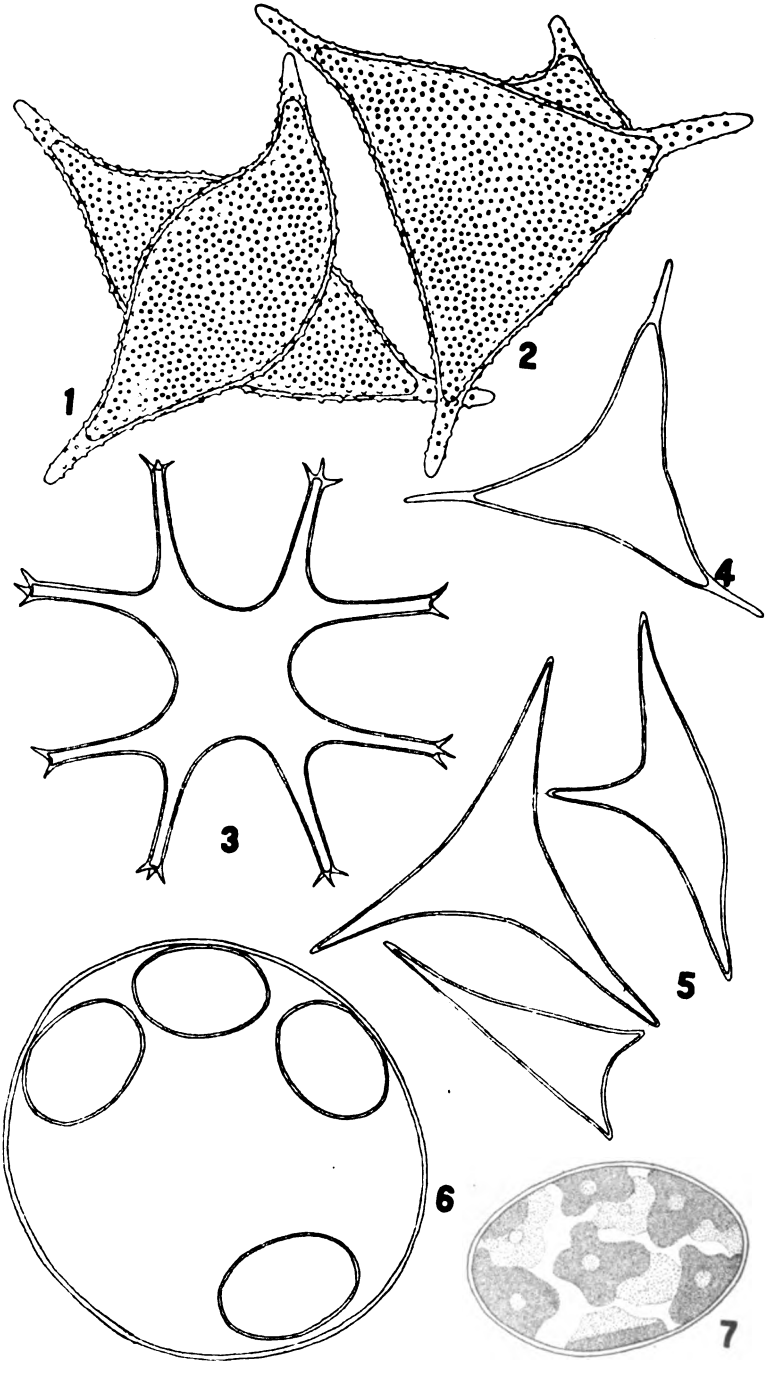

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